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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 19, NUMBER 8
AUGUST 1986

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GEOLOGICAL SURVEY

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1986

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

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SUBJECT INDEX

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ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

PREDICTIVE SIMULATIONS OF ALTERNATIVES FOR MANAGING THE WATER RESOURCES OF NORTH FORK SOLOMON RIVER VALLEY BETWEEN KIRWIN DAM AND WACONDA LAKE, NORTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
R. D. Burnett.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4249, 1984. 34 p, 22 fig, 2 tab, 18 ref.

Descriptors: *Simulation analysis, *Model studies, *Water management, Alluvial aquifers, *Surface-groundwater relations, Drawdown, Water levels, *North Fork Solomon River, Kirwin Reservoir, Waconda Lake, *Kansas.

Since 1974 water levels in the alluvial aquifer of the North Fork Solomon River Valley in north-central Kansas have decreased due to increases in ground-water pumpage, decreases in availability of surface water for irrigation, and below-average precipitation. A finite-element model was developed in cooperation with the U.S. Bureau of Reclamation to simulate changing conditions between 1970-79. Model results indicate that annual recharge to the aquifer due to precipitation, application of water for irrigation, and canal leakage averaged about 22,825 acre-feet and that annual ground-wate discharge to the river averaged about 16,590 acre-feet. Predictive simulations for 1980-2000 were made using management alternatives that involved clay-lining of irrigation ditches, reduction of surface-water availability with and without an increase in ground-water pumping, and continuation of 1979 pumping conditions. The simulations indicated that as much as 5.5 feet of additional average water-level drawdown in wells would occur by 2000 if surface-water supply were reduced 100 percent and ground-water pumpage increased. The simulations also indicated that a decrease in average drawdown of 0.55 foot would occur by 2000 and that base flow to the river would decrease to 12,300 acre-feet per year if 1979 conditions remained constant. (USGS)
W86-02941

HYDROLOGY AND SEDIMENT TRANSPORT MOANALUA VALLEY, OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-03034

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1982,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03106

THEORETICAL AND OBSERVED PROFILES OF TIDAL CURRENTS AT TWO SITES ON THE SOUTHEASTERN BERING SEA SHELF,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2L.
W86-03237

AUSTIN, TEXAS, FLOOD OF MAY 24-25, 1981,
Texas Univ. at Austin. Dept. of Civil Engineering.
W. L. Moore, E. Cook, R. S. Gooch, and C. F. Nordin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139352, Price codes: A04 in paper copy, A01 in microfiche. National Academy Press, Washington, DC, 1982. 54 p, 12 fig, 1 tab, 9 ref, 1 append.

Descriptors: *Floods, *Flood control, *Texas, *Flood damage, Flood data, Flood flow, Flood hydrographs, Flood plain management, Flood plain zoning, Flood plains, Flood protection, Flooding, Austin.

A severe flood in Austin, Texas, which occurred on May 24, 1981, is discussed, with a focus on a description of the flood, and its consequences. Local policies for flood hazard areas, local response to severe flooding, and the principles of flood hazard in urban areas, in general, are then discussed. The specific factors that caused the flooding in Austin are outlined; they include: watersheds were saturated by moderate rainfall prior to the peak intensities that produced flooding; the Shoal Creek watershed experienced a 100-year flood event; many homes along Shoal Creek built prior to adoption of current floodplain regulations were located within the 100-year floodplain; and, additional development had taken place in the upper portion of the watershed. (Halterman-PTT)
W86-03260

NATIONAL VERIFICATION PLAN: REPORT OF THE NATIONAL VERIFICATION TASK TEAM.
National Weather Service, Silver Spring, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117507, Price codes: A05 in paper copy, A01 in microfiche. June 1982. 81 p, 8 fig, 12 tab, 3 app.

Descriptors: *Data interpretation, Forecasting, *Weather forecasting, Prediction, *Flood forecasting, *Streamflow forecasting, *Baseline studies, *Management planning, Projections, Decision making, Meteorology, Water supply, Automation.

The National Verification Plan (NVP) outlines a comprehensive and ambitious forecast program designed to meet the verification needs of National Weather Service (NWS) forecasters and management at local, regional, and national levels. The plan emphasizes minimizing workload, especially at the local level, and providing results in a timely manner. The NVP provides for the establishment of baselines of skill and accuracy against which subsequent changes in forecast procedures or products can be measured. The NVP contains eight sub-plans which verify public forecast, aviation forecast, watch/warning, marine forecast, agrimeteorological forecast, forestry and fire meteorological forecast, air pollution forecast and hydrologic forecast. Analysis of the products of the hydrologic services program of the NWS suggests that the following elements should be included in the verification: stage forecast, crest stage forecast, flood event forecast, water supply forecasts and outlooks, lake level forecasts, reservoir inflow forecasts, spring flood outlook, and exteneded streamflow outlook. Included in the NVP implementation strategy are plans to automate all verification procedures. These data can then be used in making decisions concerning needed research and development and the composition of training programs.
W86-03292

WORKSHOP ON RIVERINE WATER QUALITY MODELING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 7B.
W86-03293

KEILSON-ROSS PROCEDURE FOR ESTIMATING CLIMATIC PROBABILITIES OF DURATION OF WEATHER CONDITIONS,
Air Force Geophysics Lab., Hanscom AFB, MA.
I. I. Gringorten.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A119860, Price codes: A03 in paper copy, A01 in microfiche. Environmental Research Papers, No. 775, Report No. AFGL-TR-82-0116, April, 1982. 27 p, 3 fig, 1 tab, 2 app, 8 ref.

Descriptors: *Mathematical studies, *Simulation analysis, *Mathematical models, *Weather, Climatic data, Markov process, Probabilitistic process, *Computer programs, *Computer models, *Weather forecasting, Probability distribution, Monte Carlo method, Statistical methods, Statistical analysis, Stochastic process, Prediction, Time series analysis, Fortran.

The Keilson-Ross procedure is a recent mathematical development for analytically computing the probability of the maximum of a continuous weather element over a specified time interval. As long as the weather conditioncan be defined by a Markov (Ornstein-Uhlenbeck) process, the time interval may be a duration of a few seconds to a few weeks. The procedure is applied to estimating the probability of the surface air temperatures of Minneapolis, Minnesota remaining below freezing for specified time intervals. The analytical solutions provide corrections to previously estimated probabilities that had been determined by Monte Carlo simulation. More rapid solutions to the procedure are still needed. The application of computer programs to the calculations have provided answers with a high degree of accuracy. These programs make use of cubic B-splines. A printout of the program writtern in FORTRAN is included.
W86-03294

NEPONSET RIVER BASIN MASSACHUSETTS, FLOOD PLAIN MANAGEMENT STUDY,
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-120051, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Investigation, Review Draft, March, 1982. 110 p. 11 tab, 3 plates, 6 app.

Descriptors: *Massachusetts, *Nonstructural alternatives, *Flood control, *Flood protection, Watershed management, Flood plains, Flood profiles, Flood damage, Neponset River basin, Massachusetts, Planning, Interagency cooperation, Hydrology, Cost analysis, Economic aspects.

Analysis of alternative flood plain management measures during Stage 2 investigations for the Neponset River Basin in Massachusetts indicates that structural protection is not economically feasible for any individual damage site. Under existing conditions natural valley storage reduces flood damage in the watershed significantly. The extent of the flood plains has not changed significantly since the last major flood event in 1968. Flood damage is not expected to increase in the future. Existing legislation, if enforced, can effectively keep flood damage at a minimum. Structural local protection measures for any individual damage site are not economically justified. Acquisition of natural valley storage areas throughout the Neponset River Basin is not required because of the existence of legislation capable of controlling the extent of future development. Provision of data, including detailed mapping, compiled during this study will contribute to effective enforcement of current institutional measures.
W86-03310

LITERATURE SURVEY ON THE WETLAND VEGETATION OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology and Museum.
A. R. Batten, and D. F. Murray.
Technical Report Y-82-2, Army Engineer Waterways Experiment Station, Vicksburg, MS, August 1982. Final Report. 222 p, 24 fig, 120 ref. DACW39-76-M-2473.

Descriptors: Wetlands, *Literature review, *Alaska, *Vegetation, *Aquatic plants, *Marsh plants, *Flora, *Plant populations, Lakes, Streams, Reviews, Marshes, Ponds, Rivers, Intertidal areas, Peat bogs, Coastal marshes, Salt marshes, Tidal marshes, Bogs, Swamps Tide lands, Submerged lands, Estuaries, Tidal flats.

This report contains a relatively comprehensive summary, through July 1977, of the literature pertaining to the wetland vegetation of Alaska. For organizational purposes, Alaska is divided into eight geographic regions namely Southeastern

Alaska, Southcentral Alaska, Aleutian Islands, Bering Sea Islands, Bering Sea Mainland, Chukchi Sea, Beaufort Sea Coast, and Interior Alaska. Alaska's wetlands are classified under a broad framework of eight categories within which specific vegetation types are discussed. These include (for fresh water wetlands) ponds and lakes, freshwater marshes, peatlands, streams and riparian gravel bars and cutbanks, and (for saline or brackish water wetlands) strands and supratidal meadows, saline or brackish marshes, and intertidal zones. The literature is reviewed for each of these categories within each of the eight geographic regions.
W86-03312

2B. Precipitation

DROUGHT OF 1980-82 IN SOUTHEAST FLORIDA WITH COMPARISON TO THE 1961-62 AND 1970-71 DROUGHTS,
Geological Survey, Miami, FL. Water Resources Div.
B. G. Waller.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4152, 1985. 29 p, 9 fig, 5 tab, 8 ref.

Descriptors: *Drought, *Rainfall, Water level, *Groundwater levels, *Lake levels, *Saline-freshwater interfaces, *Water storage, Flow augmentation, Frequency analysis, *Florida, Lake Okeechobee, Water conservation areas.

South-central Florida (the Kissimmee Basin) experienced a severe drought during 1980-82, causing Lake Okeechobee--the largest surface-water storage area in south Florida--to reach the lowest stage ever recorded, 9.75 feet above sea level, on July 29, 1981. A prolonged period of deficient rainfall extended from June 1980 to March 1982. On the southeast coast, drought conditions were mitigated on August 16, 1981, when rainfall from Tropical Storm Dennis replenished the coastal aquifers and filled the water conservation areas to near scheduled levels. South Dade County was the only area in south Florida not affected by the drought. Rainfall in the southeast coastal areas had a statistical recurrence ranging from 5 to 20 years whereas the recurrence intervals from some stations in south-central Florida were in excess of 100 years. The 1980-81 drought in southeast Flrodia was not as severe as the 1961-62 or the 1970-71 droughts in terms of rainfall conditions or the effect on water levels. The effects of the drought were less severe because of a combination of water-management practices and periodic rainfall during the otherwise rain-deficient period. (USGS)
W86-03082

RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS OF EASTERN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03092

PROPOSED 10-YEAR PLAN FOR CONTINUATION OF HYDROLOGIC STUDIES OF THE EDWARDS AQUIFER, SAN ANTONIO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03104

VEGETATION AND CLIMATES OF THE LAST 45,000 YEARS IN THE VICINITY OF THE NEVADA TEST SITE, SOUTH-CENTRAL NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2I.
W86-03168

TOTAL PRECIPITABLE WATER AND RAINFALL DETERMINATIONS FROM THE SEASAT SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR),
National Environmental Satellite, Data, and Information Service, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-138263, Price codes: A03 in paper copy, A01 in microfiche. NOAA Technical Report NESS 90, May 1982. 34 p, 7 fig, 10 tab, 19 ref, 3 append.

Descriptors: *Satellite technology, *Precipitation, *Radiometry, *Seasat, *Radiosondes, *Rainfall, *Remote sensing, Algorithms, Mathematical studies, Statistical methods, Rainfall rate, Mathematical models, Computer programs, Data acquisition, Data collections, Meteorological data collections.

Three of the five sensors of thee Scanning Multichannel Microwave Radiometer (SMMR) of the SEASAT oceanography satellite can be used to determine the total precipitable water in the atmosphere, the liquid water content, and the rainfall rate. In addition two distinct algorithms were used to derive geophysical parameters from brightness temperature. Comparisons with surface observations from the Gulf of Alaska SEASAT Experiment and with other selected sources were made for both algorithms. In general, very good agreement was found between satellite and radiosonde observations of total precipitable water. An estimate of the precision of radiosonde-derived total precipitable water amounts was made along with comparisons of precipitation occurrence as determined from the SMMR and surface observations. In the tropics, very good agreement is observed between satellite and surface observations. In the midlatitudes (Gulf of Alaska) small cells of precipitation are often missed by the SMMR, while larger synoptic scale precipitation is detected. Radiosonde observation tabulations and corrections, listings of computer programs, and radiosonde observation precision statistics are given in three appendices to this report. (Geiger-PTT)
W86-03238

PROJECT SKYWATER 1983-84 SCPP DATA INVENTORY: SIERRA COOPERATIVE PILOT PROJECT,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Resources Research.
October 1984. 161 p, 42 fig, 37 tab, 4 append.

Descriptors: *Weather modification, *Artificial precipitation, *Cloud seeding, Satellite technology, Weather data collection, Meteorological data collection, Data collection, Precipitation, Rain gages, Cloud physics, Weather, Clouds.

An inventory of all data collected from October 15, 1983, through April, 1984, in association with the Sierra Cooperative Pilot Project, a weather modification research project, is presented. The inventory covers forecasting, radar and satellite use, aircraft, surface meteorological observations, precipitation gage network, ground-based microphysical observations, radiometry, cooperative and operational seeding activities, snow chemistry measurements, and the roles of the National Weather Service, the Federal Aviation Administration and the National Climatic Center in the program. (Halterman-PTT)
W86-03278

INTERNATIONAL COMPARISON OF NATIONAL PRECIPITATION GAUGES WITH A REFERENCE PIT GAUGE,
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 7B.
W86-03414

2C. Snow, Ice, and Frost

PERFORMANCE OF ICE METER AND WEIGHT ASSEMBLIES,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03004

SURFACE TOPOGRAPHY OF THE LOWER PART OF COLUMBIA GLACIER, ALASKA, 1974-1981,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Rasmussen, and M. F. Meier.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Professional Paper 1258-E, 1985. 63 p, 17 fig, 8 tab, 20 ref.

Descriptors: *Glaciers, Statistical analysis, Mathematical studies, Topography, *Alaska, *Columbia Glacier, Mapping, Aerial photography.

For each of 27 series of vertical air photographs, the method of optimum interpolation was used to get surface altitudes at 154 nodes of a 762.5-m square grid over the lowest 18 km of Columbia Glacier, Alaska. Photogrammetrically produced surface topography maps for flights on July 27, 1974, and September 1, 1981, were used as the bases for norm fields for the 27 intervening flights, and the altitude deviations of individual photogrammetry points (IPP's) from those norm fields were interpolated. Between 116 and 200 IPP's were available from flight to flight. The random error in the IPP altitudes is estimated at 3.5m, and their deviations about the norm fields are also about 3.5m. The statistical structure of the surface topography was investigated; its correlation has a high degree of homogeneity and isotropy, both spatially and temporally, and is little affected by the glacier flow. The error in the interpolated results is about 2.5m. A ground-truth sample of 58 individual and averaged surface-surveyed points was used to test the interpolated results for three flights. The asymmetry of these sample deviations about the norm fields suggests that there may be a systematic error of about +1.5m in the IPP altitudes. (USGS)
W86-03039

SATELLITE OBSERVATION OF GREAT LAKES ICE: 1980-81,
National Environmental Satellite, Data, and Information Service, Washington, DC.
A. L. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-156877, Price codes: A03 in paper copy, A01 in microfiche. NOAA Technical Memorandum NESS 119, December 1982. 36 p, 27 fig.

Descriptors: *Great Lakes, *Ice cover, *Ice formation, *Satellite technology, *Ice breakup, *Iced lakes, *Lake ice, Remote sensing, Radiometry, Wind, Lake breezes, Air temperature, Lakes, Ice drift.

Ice conditions on the Great Lakes and Lake St. Clair were studied from satellite imagery. Data were collected by Geostationary Operational Satellites with Visible and Spin Scan Radiometer Sensors. The study examined the formation, movement, and dissipation of lake ice from December 1980 - May 1981. Wind speed and directions were studied as components of ice formation and dissipation. Results showed that ice was present on Lake Erie from December 20 to about May 2, a total of 132 days, with maximum extent of ice occurring February 27 accompanied by 70% concentration. The ice season on Lake St. Clair began December 14 and ended near March 31 with 100% coverage observed as early as January 7. The ice season on Lake Huron began on December 13 and lasted until April 16, a total of 124 days with maximum ice extent (65% concentration) occurring February 14. The ice season on Lake Ontario lasted from December 3 until April 2, a total of 80 days, with maximum ice extent occurring about February 5. The ice season on Lake Superior began December 13 and lasted until May 6, a total of 133 days with maximum ice extent occurring February 12. In general, ice formed on the lakes in response to northwesternly and northerly winds accompanied by below freezing air temperatures, and dissipated with winds from a southernly and southwesterly direction. (Geiger-PTT)
W86-03258

FROST ACTION IN SOIL FOUNDATIONS AND CONTROL OF SURFACE STRUCTURE HEAVING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones, D. G. Miedema, and J. S. Watkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118299, Price codes: A04 in paper copy, A01 in microfiche. REC-ERC-82-17, June, 1982. 69 p, 42 fig, 3 app, 33 ref.

Descriptors: *Frost heaving, *Frost protection, *Soil water, *Soil mechanics, *Freeze-thaw tests, *Foundation failure, *Soil structure, *Structural engineering, Frost, Frost thrusting, Heaving, Freezing, Spillways, Canal linings, Dams, Earth dams, Dam foundations.

Surveys conducted by the Bureau of Reclamation showed that seasonal frost action in soil foundations was a consideration in all regions except the Mid-Pacific, Lower Colorado, and Southwest Regions. Significant frost heave in soils occurs in cold climates when certain fine-grained soils have access to sources of water and an open-freezing system exists. Under heterogeneous soil and moisture conditions, damage to structures is caused by differential movement during freezing and thawing. Investigations for potential frost problems should consider climatic conditions, surveys of existing structures in the area, foundation exploration and soil sampling, laboratory freeze-thaw tests on soil, and location of groundwater depth. Methods of controlling frost action to prevent damage to structures include location of the foundation below the frost line, replacement of frost-susceptible soil, restriction of water supply to the frost zone, and the use of insulation to prevent frost penetration. Structures which have suffered the most heavy damage from frost action include spillways, chutes and drop structures, checks, pipe turnouts, pier-supported pipe, canal linings, and earth embankment dams. Polystyrene insulation has shown promise in field tests for the control of frost heave.
W86-03317

2E. Streamflow and Runoff

METHOD OF ESTIMATING FLOOD VOLUMES IN WESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02922

RELATIONS OF URBAN LAND-USE AND DRY-WEATHER STORM AND SNOWMELT FLOW CHARACTERTISTICS TO STREAM-WATER QUALITY, SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02926

HYDROLOGY OF AREA 61 NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
P. O. Abbott, A. L. Geldon, D. Cain, A. P. Hall, and P. Edelmann.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-132, 1983. 99 p, 81 fig, 13 tab, 125 ref.

Descriptors: *Hydrology, *Coal mining, Surface water, Groundwater, Water quality, Temperature, Precipitation, Land use, Water use, Stream biota, Flow duration, High flow, Low flow, Arkansas River, *Colorado, *New Mexico, *Coal mining, Raton Mesa coal region, Huerfano River, Apishapa River, Purgatoire River, Canadian River, Vermejo River, Cimarron River, Huerffano County, Las Animas County, Colfax County, Northern Great Plains, Coal Provinces, Rocky Mountain Coal Province.

Area 61 is located on the Colorado-New Mexico boundary in Huerfano and Las Animas Counties, Colorado, and Colfax County, New Mexico, and includes the Raton Mesa coal region. The 5,900-square-mile area is an asymmetrical structural trough bounded by the Rocky Mountains on the west and the Great Plains on the east. The area is drained by the Huerfano, Apishapa, Purgatoire, and Canadian Rivers (and their tributaries), all tributary to the Arkansas River. The principal coal-bearing formations are the Vermejo Formation of Late Cretaceous age and the Raton Formation of Late Cretaceous and Paleocene age. Much of the coal in the area is of coking quality, important to the metallurgical industry. Topographic relief in the area is greater than 8,700 feet, and this influences the climate which in turn affects the runoff pattern of area streams. Summer thunderstorms often result in flash floods. Virtually all geologic units in the region yield water. Depth to ground water ranges from land surface to 400 feet. Surface and ground water in the area contain mostly bicarbonate and sulfate ions; locally in the ground water, chloride ions predominate. Potential hydrologic problems associated with surface coal mining in the area are water-quality degradation, water-table decline, and increased erosion and sedimentation. (USGS)
W86-02934

PEAK FLOW, VOLUME, AND FREQUENCY OF THE JANUARY 1982 FLOOD, SANTA CRUZ MOUNTAINS AND VICINITY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02935

HYDROLOGIC EFFECTS OF IMPOUNDMENTS IN SHERBURNE NATIONAL WILDLIFE REFUGE, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02939

PRELIMINARY APPRAISAL OF THE HYDROLOGY OF THE RED OAK AREA, LATIMER COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02951

FLOOD-DISCHARGE PROFILES OF SELECTED STREAMS IN ROCKLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. Lumia.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4049, 1984. 32 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Flood frequency, *Flood profiles, *Rainfall-runoff relationships, Regression analysis, Regional analysis, Error analysis, Rockland County, *New York, HEC-1 model, Basin characteristics.

Flood-discharge profiles of 10 streams in Rockland County at six recurrence intervals ranging from 2 to 100 years are presented. Synthetic flood-frequency estimates were derived for nine rainfall-runoff sites from calibrated models; observed flood-frequency estimates were derived for three sites having long-term discharge records. A variance-weighting technique was applied to compare the synthetic flood-frequency estimates with the observed (gaged) estimates and estimates computed at each site from regional regression equations. For ungaged locations on the 10 streams, flood-frequency relationships were derived from regional regression equations previously developed for New Jersey streams. Regional analysis indicated the most significant basin characteristics to be drainage area, streambed slope, storage, and amount of impervious cover. A method for refining (weighting) flood-frequency estimates at selected ungaged locations near rainfall-runoff and (or) long-term gaged sites is given. This report explains analytical methods and includes a list of basin characteristics at several locations along each stream and a table of peak discharges for the six recurrence intervals at 13 gaging stations. The profiles enable the determination of flood discharge at all locations having a drainage area greater than 1 square mile on the 10 streams. (USGS)
W86-02960

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--COASTAL RIVER BASINS OF THE SOUTH SHORE AND BUZZARDS BAY,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02962

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--THAMES RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02963

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--BLACKSTONE RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02965

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--HOUSATONIC RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02966

FLOODS OF MAY 1978 IN SOUTHEASTERN MONTANA AND NORTHEASTERN WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
C. Parrett, D. D. Carlson, G. S. Craig, and E. H. Chin.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Professional Paper 1244, 1984. 74 p, 33 fig, 8 tab, 14 ref.

Descriptors: *Floods, Flood Data, *Flood Discharge, *Flood Frequency, Flood Damage, Flood Peaks, *Montana, *Wyoming, *Yellowstone River, Belle Fourche River, Cheyenne River, North Platte River, Big Horn River, Powder River.

Heavy rain and some snow fell on previously saturated ground over southeastern Montana and northeastern Wyoming during May 16-19, 1978. The maximum amount of 7.60 inches within a 72-hour period observed at Lame Deer, Montana, set a record for the month of May in that region. Heavy flooding occurred in the drainages of the Yellowstone River and its tributaries as well as the Belle Fourche, Cheyenne, and North Platte Rivers. The previous maximum flood of record was exceeded at 48 gaged sites, and the 1-percent chance flood was equaled or exceeded at 24 sites. Flood damage was extensive, exceeding $33 million. Nineteen counties in the two States were declared major disaster areas. Mean daily suspended-sediment discharges exceeded previously recorded maximum mean daily values at four sites on the Powder River. The maximum daily suspended-sediment discharge of 2,810,000 tons per day occurred on May 20 at the Site Powder River near Arvada, Wyoming. (USGS)
W86-02971

STREAMFLOW CHARACTERISTICS OF MOUNTAIN STREAMS IN WESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
C. Parrett, and J. A. Hull.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Water-Supply Paper 2260, 1985. 58 p, 14 fig, 24 tab, 9 ref.

Descriptors: *Annual runoff, *Flow duration, Regression analysis, Estimating equations, Gaging stations, Crest Gages, *Mean annual discharge, *Mean monthly discharge, *Montana, Basin characteristics.

Once-monthly streamflow measurements were used to estimate long-term mean annual flow, mean monthly flow, and various points on the flow-duration curve for 72 sites in the mountainous portions of western Montana. The estimated flow characteristics at 56 measurement sites, together with data from 22 gaging stations, were used to develop maps showing the variability of mean annual runoff for three areas. Data from all measurement sites plus data from 34 gaging stations were used to develop regression equations relating mean annual flow to drainage area and precipitation and equations relating flows of 10, 20, 30, 40, 50, 60, 70, 80, and 90 percent exceedance probability to mean annual flow. The study area was divided into two regions with a different set of estimating equations applicable to each region. Average errors of prediction were also calculated using data withheld from the regression analyses. The estimated average error for predicting mean annual flow was -16 percent in one region and -23 percent in the other region. The estimated average prediction errors for flows of various exceedance percentages ranged from +2 percent to -38 percent in one region and from +18 percent to -23 percent in the other region. (USGS)
W86-02972

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02973

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--TAUNTON AND TENMILE RIVER BASINS AND COASTAL RIVER BASINS OF MOUNT HOPE BAY, NARRAGANSETT BAY, AND RHODE ISLAND SOUND,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-02976

USE OF SELECTED BASIN CHARACTERISTICS TO ESTIMATE MEAN ANNUAL RUNOFF AND PEAK DISCHARGES FOR UNGAGED STREAMS IN DRAINAGE BASINS CONTAINING STRIPPABLE COAL RESOURCES, NORTHWESTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02978

MAPS TO ESTIMATE AVERAGE STREAMFLOW AND HEADWATER LIMITS FOR STREAMS IN U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT, ALABAMA AND ADJACENT STATES,
Geological Survey, Montgomery, AL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02981

TRAVELTIME, LONGITUDINAL-DISPERSION, REAERATION, AND BASIN CHARACTERISTICS OF THE WHITE RIVER, COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
J. M. Boyle, and N. E. Spahr.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4050, 1985. 54 p, 13 fig, 17 tab, 34 ref.

Descriptors: *Traveltime, *Reaeration, *Longitudinal dispersion, *Streamflow, Unit concentration, Basin characteristics, *White River basin, *Colorado, *Utah.

Traveltime and longitudinal-dispersion characteristics were measured for the White River using dye tracers. Discharges ranged from 281 to 1,840 cubic feet per second and velocities ranged from 1.26 to 3.17 miles per hour. Traveltimes were determined for discharges other than measured discharges by a graphical method and a linear-regression method. Longitudinal-dispersion coefficients ranged from 284 square feet per second at a discharge of 539 cubic feet per second to 5,430 square feet per second at a discharge of 1,580 cubic feet per second. Reaeration was measured in four reaches of the White River during a medium-flow period in August 1982. Reaeration coefficients at 20 degrees Celsius ranged from 5.3 to 25.3 per day. The results of a comparison with measured reaeration coefficients and reaeration coefficients predicted using empirical equations showed that the most accurate equations were by Bennett and Rathbun (1972) and Isaacs and Gaudy (1968). Basin characteristics were computed using U.S. Geological Survey topographic maps, precipitation data from the National Weather Service, and aerial photographs taken on September 11, 1981. (USGS)
W86-02984

ESTIMATION OF INCOMPLETE STREAMFLOW FOR SELECTED SITES ON THE CARSON AND TRUCKEE RIVERS IN CALIFORNIA AND NEVADA, 1944-80,
Geological Survey, Sacramento, CA. Water Resources Div.
J. C. Blodgett, R. N. Oltmann, and K. R. Poeschel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4058, 1984. 39 p, 3 fig, 8 tab, 8 ref.

Descriptors: *Stream discharge, Reservoir storage, Regression analysis, *California, Estimating equation, *Hydrograph analysis, *Hydrologic budget, Discharge, *Truckee River, Carson River, Reno, Truckee, *Nevada.

Daily mean and monthly discharges were estimated for 10 sites on the Carson and Truckee Rivers for periods of incomplete records and for tributary sites affected by reservoir regulation. On the basis of the hydrologic characteristics, stream-flow data for a water year were grouped by month or season for subsequent regression analysis. In most cases, simple linear regressions adequately defined a relation of streamflow between gaging stations, but in some instances a nonlinear relation for several months of the water year was derived. Statistical data are presented to indicate the reliability of the estimated streamflow data. Records of discharges including historical and estimated data for the gaging stations for the water years 1944-80 are presented. (USGS)
W86-02990

EVALUATION OF THE COST EFFECTIVENESS OF THE 1983 STREAM-GAGING PROGRAM IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
K. D. Medina, and C. O. Geiger.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4107, 1984. 94 p, 6 fig, 5 tab, 15 ref.

Descriptors: *Network design, *Cost analysis, Hydrologic data, Regression analysis, Discharge measurements, *Stream gaging, *Kansas, *Cost effectiveness.

The results of an evaluation of the cost effectiveness of the 1983 stream-gaging program in Kansas are documented. Data uses and funding sources were identified for the 140 complete record streamflow-gaging stations operated in Kansas during 1983 with a budget of $793,780. As a result of the evaluation of the needs and uses of data from the stream-gaging program, it was found that the 140 gaging stations were needed to meet these data requirements. The average standard error of estimation of streamflow records was 20.8 percent, assuming the 1983 budget and operating schedule of 6-week interval visitations and based on 85 of the 140 stations. It was shown that this overall level of accuracy could be improved to 18.9 percent by altering the 1983 schedule of station visitations. A minimum budget of $760,000, with a corresponding average error of estimation of 24.9 percent, is required to operate the 1983 program. None of the stations investigated were suitable for the application of alternative methods for simulating discharge records. Improved instrumentation can have a very positive impact on streamflow uncertainties by decreasing lost record. (USGS)
W86-02992

LOW-FLOW CHARACTERISTICS OF KENTUCKY STREAMS, 1983,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02998

LOW-FLOW DATA FOR SELECTED PARTIAL-RECORD STATIONS IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03003

PERFORMANCE OF ICE METER AND WEIGHT ASSEMBLIES,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03004

IMPACT OF AN OUTBURST OF SPIRIT LAKE ON THE COLUMBIA RIVER,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-03008

STORM RUNOFF AS RELATED TO URBANIZATION BASED ON DATA COLLECTED IN SALEM, AND PORTLAND, AND GENERALIZED FOR THE WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03015

HYDROLOGY, GEMORPHOLOGY, AND DAM-BREAK MODELING OF THE JULY 15, 1982, LAWN LAKE DAM AND CASCADE LAKE DAM FAILURES, LARIMER COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8D.
W86-03017

WATER QUALITY AND STREAMFLOW DATA FOR THE WEST FORK TRINITY RIVER IN FORT WORTH, TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03020

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1983 - NOVEMBER 30, 1984,
Geological Survey, Reston, VA. Water Resources

Div.
F. T. Schaefer, W. E. Harkness, R. W. Baebenroth, and D. W. Speight.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-339, 1985. 83 p, 6 fig, 21 tab.

Descriptors: *Delaware River, Diversion, Release, Water management, Drought, *Water quality, *Reservoir yield, Regulation, Supply, Inter-Basin transfers.

A Decree of the U.S. Supreme Court in 1954 established the position of Delaware River Master. The Decree authorizes diversions of water from the Delaware River basin and requires compensating releases from certain reservoirs of the City of New York to be made under the supervision and direction of the River Master. Reports to the Court, not less frequently than annually were stipulated. During the 1984 report year, December 1, 1983 to November 30, 1984, precipitation and runoff varied from above average to below average in the Delaware River basin. For the year as a whole, precipitation and runoff were near average. Operations were under a status of drought warning December 1, 1983; however, the above normal precipitation the first half of the year increased storage in the reservoirs to record levels by June 1, 1984. Below normal precipitation from August to November coupled with large releases to maintain the Montague flow objective and customary diversions for water supply reduced storage in the reservoirs to the drought-warning level by November 27. Diversions from the Delaware River basin by New York City and New Jersey conformed to the terms of the Amended Decree throughout the year. Releases were made as directed by the River Master at rates designed to meet the Montague flow objective on 127 days between June 23 and November 30. Releases were made at conservation rates or at rates designed to relieve thermal stress in the streams downstream from the reservoirs at other times. (USGS)
W86-03023

WATER-RESOURCES APPRAISAL OF THE UPPER ARKANSAS RIVER BASIN FROM LEADVILLE TO PUEBLO, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
T. M. Crouch, P.O. Abbott, R. D. Penley, R. T. Hurr, and D. Cain.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-4114, 1984. 123 p, 8 pl, 30 fig, 76 ref.

Descriptors: Geochemistry, *Hydrogeology, Surface water, Aquifers, *Water supply, *Groundwater movement, Groundwater storage, *Streamflow characteristics, *Hydrologic data, Dissolved solids, Mercury, Selenium, Transmountain diversions, *Arkansas River, Buena Vista-Salida basin, Leadville basin, Wet Mountain Valley, Pueblo Reservoir, *Colorado.

Water used for agriculture and stock and municipal supplies in the upper Arkansas River basin is derived mostly from the Arkansas River and its tributaries. The flow regime of the river has been altered by increased reservoir capacities and importation of 69,200 acre-feet per year from the Colorado River drainage through transmountain diversions. An estimated 10.2 million acre-feet of hydrologically recoverable water is present in the first 200 feet of basin-fill alluvium. Well yields of 300 gallons per minute have been reported for the Dakota-Purgatoire aquifer aquifer located east of Canon City. Water quality of ground- and surface-water resources are generally acceptable for agriculture and stock watering, but concentrations of iron, manganese, sulfate, pH, and hardness may exceed recommended drinking-water criteria during periods of river low flow. Concentrations of mercury, selenium, and select radiochemical constituents also were high in the Dakota-Purgatoire aquifer. Dissolved solids increased downstream and in local areas as a result of water use and in the Leadville area because of mine drainage. (USGS)
W86-03025

FLOOD-PROFILE ANALYSIS, BIG DARBY CREEK AT STATE ROUTE 762, ORIENT, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03027

ASSESSMENT OF A STEADY-STATE PROPANE-GAS TRACER METHOD FOR DETERMINING REAERATION COEFFICIENTS-CHENANGO RIVER,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03033

USES, FUNDING, AND AVAILABILITY OF CONTINUOUS STREAMFLOW DATA IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03036

SYNTHESIZED FLOOD FREQUENCY FOR SMALL URBAN STREAMS IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. H. Robbins.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4182, 1984. 24 p, 14 fig, 3 tab, 16 ref.

Descriptors: *Urbanization, *Flood frequency equations, Basin development factors, Effective impervious area, Rainfall, Floods, *Tennessee.

Bridge, culvert, and highway design often require knowledge of the magnitude and frequency of flood discharge from small streams where the drainage basin is urbanized. The results of a 6-year study by the U.S. Geological Survey provide methods for estimating flood magnitudes for selected frequencies on small streams draining urban areas in Tennessee. A total of 22 rainfall-runoff sites located in basins with drainage areas of 0.21 to 24.3 square miles in size and in municipalities with populations between 5,000 and 100,000 were used to derive regionalized flood-frequency equations. Impervious area, measured from recent aerial photographs, ranged between 4.7 percent and 74.0 percent of the basin. The equations were derived by multiple regression analyses of snythetic flood-frequency estimates, derived from a rainfall-runoff modeling procedure, versus physical basin characteristics and a precipitation factor. These equations can be used to estimate the magnitude of future floods with recurrence intervals of 2 to 100 years on ungaged urbanized streams in Tennessee. One equation for each recurrence interval applies statewide. Flood-frequency estimates for stations used in the analyses and example computations demonstrating applications of the regression equations to urban streams in Tennessee are given in the report. (USGS)
W86-03037

MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH SEPTEMBER 1981,
Geological Survey, Albany, NY. Water Resources Div.
J. A. Robideau, P. M. Burke, and R. Lumia.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-927, 1984. 83 p, 3 fig, 1 tab, 28 ref.

Descriptors: *Flood peak, *Stage, *Discharge, Indirect flood measurement, Gaging stations, Historic floods, Data collections, *New York, Flood potential, Envelope curves.

This report lists the maximum known stages and discharges of New York streams through September 1981. The data represent 1,189 sites. Most data were obtained from files of the U.S. Geological Survey, but some were provided by other Federal, State, and private organizations. The information is grouped by major drainage basins and listed by U.S. Geological Survey station number in downstream order. Given are county names, drainage area (in square miles), period of record, type of site (continuous record, partial record, miscellaneous measurement), date of discharge, stage, elevation, discharge, and remarks. An envelope curve for the New York data was developed from a plot of maximum known discharge versus drainage area, and was compared with a like curve derived from maximum known discharge data gathered throughout the United States. The national curve ranges from about 3.0 times higher than the New York curve at a drainage area of 1.0 square mile to about 4.5 times higher at 1,000 square miles. The relative magnitude of flood discharges in four hydrologic regions of New York (west, north, southeast, Long Island) is shown in graphs relating maximum known discharge to drainage area. (USGS)
W86-03038

PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION, FOR PUERTO RICO AND THE U.S. VIRGIN ISLANDS,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 10C.
W86-03047

VALIDITY OF DARCY'S LAW UNDER TRANSIENT CONDITIONS,
Geological Survey, Reston, VA. Water Resources Div.
C. E. Mongan.
Available from Dist Branch, USGS, 604 S. Pickett, VA 22034. USGS Professional Paper 1331, 1985. 16 p, 4 fig, 1 tab, 20 ref.

Descriptors: *Darcy's law, Capillary flow, Laminar flow, Reynolds number, *Unsteady flow, Bessel description, Time constant, Navier-Stokes equation, Step functions, Ramp functions, Hankel transforms.

Darcy's Law, which describes fluid flow through porous materials, was developed for steady flow conditions. The validity of applying this law to transient flows has been mathematically verified for most ground-water flow conditions. The verification was accomplished through application of Hankel transforms to linearized Navier-Stokes equations which described flow in a small diameter cylindrical tube. The tube was chosen to represent a single pore in a porous medium. (USGS)
W86-03049

WATER BUDGET FOR MAJOR STREAMS IN THE CENTRAL VALLEY, CALIFORNIA, 1961-77,
Geological Survey, Tahoe City, CA. Water Resources Div.
J. R. Mullen, and P. Nady.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-401, 1985. 87 p, 21 fig, 20 tab, 9 ref.

Descriptors: *Streamflow data, *Water budget, Inflow, Outflow, Theoretical flow, *California, Central Valley, Sacramento Valley, San Joaquin Valley.

A compilation of annual streamflow data for 20 major stream systems in the central Valley of California, for water years 1961-77, is presented. The water-budget tables list gaged and ungaged inflow from tributaries and canals, diversions, and gaged outflow. Theoretical outflow and gain or loss in a reach are computed. A schematic diagram and explanation of the data are provided for each water-budget table. (USGS)
W86-03050

STREAM-GAGING PROGRAM IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.

For primary bibliographic entry see Field 7B.
W86-03057

SIMULATED EFFECTS OF PROPOSED RESERVOIR-DEVELOPMENT ALTERNATIVES ON STREAMFLOW QUANTITY IN THE WHITE RIVER, COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03061

STREAMFLOW IN THE SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. L. Lindskov, and B. A. Kimball.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Supply Paper 2224, 1984. 72 p, 60 fig, 15 tab, 54 ref.

Descriptors: *Streamflow, *Water quality, Flow characteristics, Variability, Frequency analysis, *Utah, Oil shale, *Uinta Basin, Energy development.

Baseline conditions for streamflow and water-quality characteristics are defined for a 3,000 square-mile area in northeastern Utah and northwestern Colorado where oil-shale mining is expected to impact the water resources. Areal and time variances in these characteristics are illustrated for the Green and White Rivers and for tributary streams originating within the area. The area receives an average of 5,900 cubic feet per second from an outside drainage area of about 34,000 square miles. This is more than 100 times the runoff that originates within the study area. The average flow per unit area of the Green and White Rivers is 0.17 cubic foot per second per square mile, whereas the average flow for the tributary streams varies from less than 0.001 to more than 0.10 cubic foot per second per square mile. Evapotranspiration losses are large, causing average flows of some tributary streams to decrease in a downstream direction. The water quality in the Green and White Rivers generally is better than that in the tributary streams. Dissolved-solid concentrations average 572 milligrams per liter for the Green River and 500 milligrams per liter for the White River, whereas mean concentration for the tributary streams range from 549 milligrams per liter for ephemeral streams to 5,320 milligrams per liter for Bitter Creek. Dissolved-solids concentrations in base flow for short reaches of Bitter Creek can exceed 10,000 milligrams per liter. (USGS)
W86-03064

STREAMFLOW AND SUSPENDED-SEDIMENT DISCHARGE FROM TWO SMALL WATERSHEDS IN SOUTHWESTERN WYOMING AND NORTHEASTERN UTAH, 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. W. Lenfest, and B. H. Ringen.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-161, 1985. 26 p, 8 fig, 7 tab, 7 ref.

Descriptors: *Suspended sediments, Water quality, *Streamflow, Stage-discharge relations, Discharge hydrographs, Thief Creek, Chicken Creek, *Wyoming, *Utah.

Accelerated erosion due to mineral exploration and production in southwestern Wyoming has caused concern that the streams will transport excess sediment in these areas. Two adjacent drainage basins with different levels of development were studied to determine the effects of minerals development on water quality. A high level of minerals development was occurring in the Thief Creek drainage basin; little or no development was occurring in the Chicken Creek drainage basin. Streamflow, suspended sediment, water temperature, and specific conductance data were collected at each creek from May through September, 1984. Water samples were analyzed for common characteristics and constituents, and for trace metals, iron, and manganese. (USGS)
W86-03066

SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE UNITED STATES DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY-FISCAL YEAR 1984, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
E. F. LeRoux, and E. M. Decker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-422, 1985. 59 p, 7 fig, 4 tab.

Descriptors: *Hydrologic data, Water-resources studies, *Data collections, *Hydrologic data, Groundwater, Surface waters, *South Dakota.

Project descriptions, water-resources summaries, and lists of hydrologic-data stations are presented to show the status of the U.S. Geological survey water-resources studies in South Dakota. (USGS)
W86-03067

DATA USES AND FUNDING OF THE STREAM-GAGING PROGRAM IN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-03070

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-03073

ANNUAL YIELD AND SELECTED HYDROLOGIC DATA FOR THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS OKLAHOMA, 1984 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
M. A. Moore, and T. E. Lamb.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-179, 1985. 30 p, 1 fig, 1 tab, 2 ref.

Descriptors: *Interstate compacts, Stream discharge, Reservoir storage, *Hydrologic data, *Water yield, *Arkansas River Basin, *Arkansas, *Oklahoma, *Annual yield.

The computer annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma, are given in tables. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given in tabular form. Monthly, maximum, minimum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. (USGS)
W86-03074

SURFACE-WATER QUANTITY AND QUALITY IN THE LOWER KENAI PENINSULA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
C. S. Savard, and D. R. Scully.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4161, 1984. 62 p, 15 fig, 17 tab, 16 ref, append.

Descriptors: *Surface water availability, Low flow, High flow, *Water quality, *Alaska, Kenai Peninsula.

New information on stream discharge and quality were collected over a 2-year period in the lower Kenai Peninsula. This new information improved understanding of the area's surface-water hydrology. Average annual runoff ranges from 11 inches in the lowland portions of the peninsula to 100 inches in the Seldovia area. For drainage basins in the Kenai Lowland, maximum flood runoff rates range from about 10 to 82 cubic feet per second per square mile. In the Seldovia area maximum peak discharges range from about 65 to 280 cubic feet per second per square mile. Low-flow discharges are higher in the Seldovia area than on the lower peninsula. Calcium and bicarbonate ions dominate the water in streams draining the study area; the water is soft and has a low dissolved-solids content. Measured stream water temperatures range from 0 to 23 degrees Celsius in the Kenai Lowland and from 0 to 11.5 degrees Celsius in the Seldovia area. (USGS)
W86-03076

PRELIMINARY INVESTIGATION OF FLOW CHARACTERISTICS OF THE ALABAMA RIVER UPSTREAM FROM SELMA, ALABAMA,
Geological Survey, Montgomery, AL. Water Resources Div.
G. H. Nelson, C. O. Ming, and W. L. Psinakis.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4055, 1985. 44 p, 26 fig, 6 tab, 11 ref.

Descriptors: *Historic floods, *Water-surface profiles, *Stage-discharge relation, *Control structures, *Backwater effect, Discharge coefficient, *Alabama River, Robert F. Henry Lock and Dam, Autauga-Lowndes County Line, *Alabama.

Available data for floods in the vicinity of Montgomery since the late 1800's indicate that the flood of 1886 is the highest since settlement of the area in 1814. Profiles for floods in 1948, 1961, 1976, and 1979 were defined using floodmarks and recorded peak stages at gaging stations at Selma and Montgomery. The floods in 1948 and 1961 occurred before construction of Robert F. Henry Lock and Dam (formerly Jones Bluff Lock and Dam and Millers Ferry Lock and Dam). Considerable water-surface differences are indicated between the profiles for periods before and after construction of the dams. The investigation included a step-backwater model to reproduce profiles based on the actual flood profiles. After the actual flood profiles were reproduced, the model was used to compute additional profiles showing the effects of varying tributary inflow. The profiles were computed for discharges ranging from 80,000 ft3/s to 500,000 ft3/s. Stage-discharge relations were then developed for five sites upstream from Selma. Discharge coefficient curves for prevalent types of flow over the spillway at Robert F. Henry Lock and Dam were developed using discharges obtained from current-meter measurements and standard discharge equations for flow through gate-controlled spillways. (USGS)
W86-03077

FLOOD FREQUENCY AND STORM RUNOFF OF URBAN AREAS OF MEMPHIS AND SHELBY COUNTY, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03078

GROUND-WATER RESOURCES OF THE MATTAPOISETT RIVER VALLEY, PLYMOUTH COUNTY, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
J. C. Olimpio, and V. de Lima.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4043, 1984. 83 p, 24 fig, 11 tab, 27 ref.

Descriptors: *Glacial aquifers, *Groundwater model, *Water table, *Water level fluctuations, Geohydrologic boundaries, Municipal pumping, *Streamflow, Streambed infiltration, Plymouth County, *Massachusetts, Surface-groundwater relationships, Mettapoisett River Valley.

Ground-water withdrawals by municipal wells in the Mettapoisett River valley, Massachusetts, are expected to triple in the next two decades. State and local concern about the long-term impacts of these withdrawals on ground-water levels and streamflow made it necessary to assess the ground-water resources of the valley and to develop a digital ground-water-flow model for management purposes. Ten pumping scenarios, which represent the present and proposed withdrawals from the aquifer, were simulated using reduced recharge conditions. Under conditions simulating 1965 average annual recharge, predicted water levels in the aquifer are as much as 9 feet lower than average annual levels. At the highest withdrawal rates, the predicted drawdown in four wells exceeds the estimated available drawdown. Under conditions representative of the 7-day 10-year low flow of the river, predicted water levels decline as much as 19 feet. Simulated withdrawals in six scenarios use all of the available ground-water discharge. If this drought condition should occur and streamflow is not supplemented by surface water, the model results indicate that the river in the southern half of the valley will stop flowing under most pumping plans. (USGS)
W86-03079

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN ORLANDO SUBDISTRICT, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
R. A. Miller, W. Anderson, and L. D. Fayard.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-resources Investigations Report 84-4116, 1984. 89 p, 24 fig, 9 tab, 48 ref.

Descriptors: Cost allocation, *Gaging stations, *Hydrography, Optimization, Data collections, *Cost-benefit analysis, *Florida, *Cost effectiveness, Traveling-salesman problem.

The results of a study of the cost-effectiveness of the stream-gaging program in central Florida are documented. Data uses and funding sources were identified for the 94 continuous-record gaging stations currently being operated in central Florida with a budget of $462,000. No stations were identified as unnecessary in the present network and no station could be replaced by data simulation using alternate methods (flow routing or regression analysis). The average standard error in estimating instantaneous discharge for the present operation is 27.8 percent. Given a budget of $550,000 and unlimited site visits the average standard error could be reduced to 17.8 percent. However this would require that one-third of the stations be visited at a frequency greater than monthly, with the remainder being visited less frequently. The logistics required for controlling personnel and vehicles would prohibit this approach from actually being used in the field. By limiting the maximum number of visits to 11 per year, a budget of $550,000 would reduce the average standard error to 20.2 percent. One presently operating site in the Withlacoochee River basin should be replaced with dam-monitoring equipment, and telecommunication equipment should be placed at remote sites in the Kissimmee River basin for the purpose of determining operating status of the recorder. (USGS)
W86-03086

FLOODING IN NORTHWESTERN HILLSBOROUGH AND SOUTHERN PASCO COUNTIES, FLORIDA, IN 1979,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. R. Murphy, R. P. Evans, and J. K. Whalen.
USGS Open-File Report 82-96, 1984. 13 map sheets, 38 fig, 4 tab, 20 ref.

Descriptors: *Flooding, *Flood stage, *Flood peak, *Flood frequency , Flood damage, *Florida, Hillsborough County, Northwestern Hillsborough County.

Heavy rainfall in the late spring and summer of 1979 caused severe flooding in northwestern Hillsborough and southern Pasco counties, including north Tampa. May 7-9 rainfall for some stations had a recurrence interval in excess of 100 years; the August and September rainfall total had a recurrence interval in excess of 50 years. The frequency of flooding of streams and lakes in the study area for the May 7-9 storm ranged from less than 2 to 25 years; for the period August to October, recurrence intervals ranged from 3 to 25 years. Areas of maximum flooding for a 48-square-mile area of northwestern Hillsborough and southern Pasco Counties are indicated on 12 sheets of aerial photography. Drainage patterns, control structures, drainage basins, and existing and proposed urban developments are shown and related to flooding. Stage and streamflow hydrographs are shown for 12 lakes and 2 streams. (USGS)
W86-03109

HYDROLOGIC DATA FOR THE LARIMER-WELD REGIONAL WATER-MONITORING PROGRAM, COLORADO, 1975-1982,
Geological Survey, Lakewood, CO. Water Resources Div.
S. R. Blakely.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-139, 1984. 201 p, 1 fig, 13 tab, 25 ref.

Descriptors: Water quality, Streamflow, Reservoir capacity, Period of record, Chemical analysis, Statistics, *Hydrologic data, Larimer County, Weld County, Big Thompson River, Cache La Poudre River, Horsetooth Reservoir, Joe Wright Creek, Michigan River, Platte River basin, *Colorado.

The Larimer-Weld, Colorado, regional Monitoring Program was begun in 1976 to provide information on the quality and quantity of the surface-water resources in the area. Three stations on the big Thompson River and five stations on the Cache La Poudre River were selected for a data-collection network. Four previously established stations were added to complete the data-collection network: Horsetooth Reservoir, Joe Wright Creek above and below Joe Wright Reservoir, and Michigan River near Cameron Pass. Station description, location, and period of record are given for each station. A statistical summary of the water-quality data for each station is tabulated. Frequency of occurrence is given at the 95th, 75th, 50th, and 25th percentiles. Monthly water-quality data and daily average streamflow data are tabulated for each streamflow station for which this data was collected; Monthly contents data are presented for Horsetooth Reservoir. All data tabulated and summarized are from the period October 1, 1975, through September 30, 1982. (USGS)
W86-03110

HYDROLOGY OF AREA 29, EASTERN REGION, INTERIOR COAL PROVINCE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
K. K. Fitzgerald, C. A. Peters, and E. E. Zuehls.
USGS Water-Resources Investigation/Open-File Report 82-858, 1983. 70 p, 57 fig, 14 tab, 64 ref.

Descriptors: Coal, *Coal mines, *Coal mine wastes, *Hydrology, Strip mines, Water pollution sources, Hydrologic data, *Illinois, Coal hydrology, Water data sources.

Hydrologic information and analysis that should be useful to mine owners, mine operators, and consulting engineers in the preparation of permits and to regulatory authorities in appraising the adequacy of permit applications is presented. The Kaskaskia River is the major river draining Area 29. Glacial deposits cover most of the area and coal-bearing Pennsylvanian rocks underlie about 95 percent of the area. Agriculture is the dominant land use. As of June, 1980, there were five active underground coal mines and two active surface mines. Ninety-six percent of the water used in Area 29 is obtained from surface-water resources. Groundwater yields vary throughout the area. There are 21 active streamflow gaging stations in Area 29. Equations have been developed for estimating mean annual streamflow, 7-day, 10-year low flow, 7-day, 10-year high flow, and the 10-year peak discharge. Water-quality data are available for 39 sites in the area. Natural conditions neutralize acidic waters resulting from drainage from coal-mining areas in Area 29, but increased concentrations of metals, such as iron, manganese, and aluminum, and other elements remain in the waters. (USGS)
W86-03111

HYDROLOGIC-DATA STATIONS AND LAKE LEVELS, KENAI-NIKISKI AREA, ALASKA, 1983,
Geological Survey, Anchorage, AK. Water Resources Div.
B. J. Bailey.
USGS Open-File Report 83-938, 1983. 2 p, 13 fig, 1 tab, 3 ref.

Descriptors: *Hydrologic data, Stations, *Networks, *Water levels, Lakes, *Lake levels, *Alaska, Kenai, Nikiski.

The locations of 2 National Weather Service stations, 29 observation wells, 4 stream gages, and 12 lake-stage stations are depicted on a 1:63, 360-scale map. The periods of record and station descriptions are listed. Hydrographs depict water-level fluctuations of 12 lakes during the period 1970-1983. (USGS)
W86-03115

TRAVELTIME AND DISPERSION IN THE POTOMAC RIVER, CUMBERLAND, MARYLAND, TO WASHINGTON, D.C.,
Geological Survey, Towson, MD. Water Resources Div.
K. R. Taylor, R. W. James, and B. M. Helinsky.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-861, 1984. 55 p, 14 fig, 7 tab, 35 ref.

Descriptors: *Traveltime, *Dye dispersion, *Solute transport, *Dye concentrations, Dam effects, Average velocity, Dye releases, *Potomac River, *Maryland, Concentration attenuation, Unit concentration, Dye cloud, Time of passage.

Data from two traveltime and dispersion studies, using rhodamine dye, are used to develop a generalized procedure for predicting traveltime and downstream concentrations resulting from spillage of water-soluble substances at any point along the Potomac River from Cumberland, Maryland, to Washington, D.C. The procedure will allow the approximate solution to almost any spillage problem concerning traveltime and concentration during periods of relatively steady flow between 50- and 95-percent flow duration. A new procedure for calculating unit peak concentration is derived. The new procedure, based on the similarity in shape of a time-concentration curve and a scalene triangle, allows unit peak concentration to be expressed in terms of the length of the dye cloud. This approach facilitates the linking of peak-concentration attenuation curves for long reaches of rivers which are divided into subreaches for study. An example problem is solved for a hypothetical spill of 20,000 pounds of contaminant at Magnolia, West Virginia. The predicted traveltime of the leading edge, peak concentration, and trailing edge to Point of Rocks, Maryland (110 miles downstream), are 295, 375, and 540 hours, respectively, for a flow duration of 80 percent. The predicted maximum concentration is 340 micrograms/L. (USGS)
W86-03123

GENERALIZED SKEW COEFFICIENT FOR FLOOD FREQUENCY COMPUTATIONS FOR THE STATE OF HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
R. Lee.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4027, 1984. 21 p, 6 fig, 5 tab, 5 ref.

Descriptors: *Generalized skew coefficient, *Hawaii, *Flood frequency, Streams, *Log-Pearson Type III distribution.

In 1976, the Hydrology Committee of the U.S. Water Resources Council estimated a generalized skew coefficient for flood frequency computations of -0.05 for the State of Hawaii. This value is the average of 30 stream gaging stations with 25 or more years of record through water year 1973. This report updates the generalized skew coefficient for the State of Hawaii to -0.14. It is the average of 68 stream gaging stations with 25 or more years of record. (USGS)
W86-03143

WATER RESOURCES DATA, ALASKA WATER YEAR 1981.
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03146

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, AND RIO GRANDE BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03147

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03148

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03149

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 1. CENTRAL AND NORTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03150

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 2, SOUTHERN LOUSIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03151

WATER RESOURCES DATA, NEW MEXICO WATER YEAR 1983,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03152

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1982, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03153

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03154

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 2. SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03155

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03156

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 2. LONG ISLAND,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03157

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 3. WESTERN NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03158

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 1, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03159

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 2,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03160

WATER RESOURCES DATA, KENTUCKY WATER YEAR 1983.
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03161

STORAGE ANALYSIS FOR EPHEMERAL STREAMS IN SEMIARID REGIONS,
Geological Survey, Cheyenne, WY. Water Resources Div.
K. C. Glover.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4078, 1984. 55p, 6 fig, 7 tab, 7 ref.

Descriptors: *Reservoir storage, *Storage-frequency curves, Semiarid climates, Probability, *Computer models, *Water supply, *Queuing theory, Computer programs(Fortran).

A model has been developed for determining the probability of a reservoir being unable to provide a specified downstream water supply. By applying the model with a number of assumed storage capacities, the long-term water supply potential of a stream below a reservoir can be evaluated. Previous methods for determining available water supply from streamflow records using a reservoir storage analysis have met with limited success in semiarid regions. The shortcomings are due to the failure of the methods to account for zero-flow periods and the high day-to-day variability of discharge of many streams. The reservoir storage model presented in this report is designed to account for these streamflow characteristics. Reservoir inflow, outflow, and evaporation are modeled as varying daily, and values of storage probability are adjusted for zero-flow periods. (USGS)
W86-03171

CHARACTERISTICS OF STREAMFLOW IN MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
D. H. Carpenter.
Maryland Geological Survey, Annapolis, Report of Investigations No 35, 1983. 237 p, 18 fig, 14 tab, 39 ref.

Descriptors: *Flow characteristics, *Low flow, *Flow duration, *Flood frequency, Regression analysis, Design floods, Regional analysis, Natural streams, Soils types, Regulated flow, Flood data, *Maryland, Peak flow, Flood volume, Low-flow frequency, Design low flows, Basin characteristics, Coastal Plain, Piedmont, Recurrence interval.

Mean-annual discharge, peak-flow, flood-volume, low-flow, and flow-duration data are presented for 124 continuous-record gaging stations reflecting both the drought of the 1960's and most of the floods of the 1970's. In addition, peak-flow data are presented for 30 crest-stage partial-record stations and selected low-flow data are presented for 111 low-flow partial-record stations. Methods are presented for estimating peak-flow magnitudes and frequencies and low-flow magnitudes and frequencies at ungaged sites. Multiple-regression techniques are used to develop equations which relate physical and climatological features of drainage basins to peak-flow and low-flow discharges for selected recurrence intervals. These regression equations are used to estimate the peak- and low-flow magnitudes at ungaged sites. The methods can be used to evaluate the reliability of the estimates. (USGS)
W86-03172

DRAINAGE AREAS IN NEW JERSEY: ATLANTIC COASTAL BASINS, SOUTH AMBOY TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
A. J. Velnich.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-150, 1984. 33 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Drainage area, *Watersheds(Basin), *New Jersey, *Gaging stations, *Water resources, Rivers, Drainage system, Surface water, Basin characteristics, Stream gazetteer.

Drainage areas of New Jersey streams in the coastal basin from South Amboy to Cape May are listed for more than 700 sites. Tables list the descriptive location of each site, the latitude and longitude, county, and National Topographic map name. For gaged sites established through 1982, the U.S. Geological Survey station name and site number are also shown. The data are presented alphabetically by stream name and in downstream order. Drainage areas were tabulated for named streams and unnamed streams with a drainage area greater than 5 square miles. The methods used to delineate the drainage divides, measure areas, and determine mouths of streams follow the guidelines developed by the U.S. Water Resources Council. (USGS)
W86-03178

WATER RESOURCES DATA, SOUTH DAKOTA WATER YEAR 1983,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03179

WATER RESOURCES DATA, TENNESSEE WATER YEAR 1983,
Geological Survey, Nashville, TN. Water Re-

sources Div.
For primary bibliographic entry see Field 7C.
W86-03180

WATER RESOURCES DATA, IDAHO WATER YEAR 1983,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03181

WATER RESOURCES DATA, IOWA WATER YEAR 1983,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03182

WATER RESOURCES DATA, KANSAS WATER YEAR 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03183

WATER RESOURCES DATA, GEORGIA WATER YEAR 1983,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03184

WATER RESOURCES DATA, NEW JERSEY WATER YEAR 1983, VOLUME 1: ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03185

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 1: EASTERN NEW YORK EXCLUDING LONG ISLAND,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03186

WATER RESOURCES DATA, ARKANSAS WATER YEAR 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03187

WATER RESOURCES DATA, OREGON, WATER YEAR 1983, VOLUME 2: WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03188

WATER RESOURCES DATA, INDIANA WATER YEAR 1983,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03189

WATER RESOURCES DATA, NEW HAMPSHIRE AND VERMONT WATER YEAR 1983,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03190

WATER RESOURCES DATA, SOUTH CAROLINA WATER YEAR 1983,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03191

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03192

WATER RESOURCES DATA, CALIFORNIA, WATER YEAR 1982, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03193

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03194

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 1. SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03195

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 2: ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03196

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 1: ILLINOIS EXCEPT ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03197

WATER RESOURCES DATA, NORTH DAKOTA WATER YEAR 1983,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03198

WATER RESOURCES DATA, NEVADA WATER YEAR 1983,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03199

WATER RESOURCES DATA, OREGON WATER YEAR 1983, VOLUME 1: EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03200

WATER RESOURCES DATA, UTAH WATER YEAR 1983,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03201

WATER RESOURCES DATA, FLORIDA WATER YEAR 1981, VOLUME 4, NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03202

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1982,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03204

WATER RESOURCES DATA, MAINE WATER YEAR 1982,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03205

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3B: SOUTHWEST FLORIDA GROUND WATER,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03206

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1A: NORTHEAST FLORIDA SURFACE WATER,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03207

WATER RESOURCES DATA, TEXAS, WATER YEAR 1982, VOLUME 3; COLORADO RIVER, LAVACA RIVER, GUADALUPE RIVER, NUECES RIVER, RIO GRANDE BASINS AND INTERVENING COASTAL BASINS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03208

WATER RESOURCES DATA, MISSOURI WATER YEAR 1983,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03209

WATER RESOURCES DATA, WYOMING WATER YEAR 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03210

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3A: SOUTHWEST FLORIDA SURFACE WATER,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03211

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1B: NORTHEAST FLORIDA GROUND WATER,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03212

WATER RESOURCES DATA, VIRGINIA WATER YEAR 1983,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03213

WATER RESOURCES DATA, MAINE WATER YEAR 1983,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03214

WATER RESOURCES DATA, WISCONSIN WATER YEAR 1983,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03215

WATER RESOURCES DATA, WEST VIRGINIA WATER YEAR 1983,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03216

WATER RESOURCES DATA, OKLAHOMA WATER YEAR 1982,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03217

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1982,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03218

WATER RESOURCES DATA, MICHIGAN WATER YEAR 1983,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03219

WATER RESOURCES DATA, ALABAMA WATER YEAR 1983,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03220

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03221

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 2: UPPER MISSISSIPPI AND MISSOURI RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03222

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 1. OHIO RIVER BASIN,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03223

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 2. ST. LAWRENCE RIVER BASIN STATEWIDE PROJECT DATA,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03224

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1983,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03225

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1983,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03226

WATER RESOURCES DATA, ARIZONA WATER YEAR 1982,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03227

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 1: HUDSON BAY AND MISSOURI RIVER BASINS,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03228

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 2, COLUMBIA RIVER BASIN,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03229

QUEBEC: SURFACE WATER DATA, 1984,
Inland Waters Directorate, Ottawa (Ontario).
1985. 49 p.

Descriptors: *Surveys, *Hydrometric stations, *Stream discharge, *Quebec, Water level, *Sediment discharge, Gages, Data collections, Hydrologic data collections, Hydrometry, Gaging, Stream gages, Flow discharge, Water level fluctuations, Tides, Rivers, Streams.

The results of the hydrometric surveys carried out by the Water Survey of Canada Division in the province of Quebec for 1984 are presented. A list of all hydrometric stations managed by the Water Survey of Canada Division in Quebec is also included. This publication summarizes the annual water level data for the Tides and Water Level Network in Quebec on the St. Lawrence River upstream of Lac St. Pierre. For gaging stations where a systematic record of water level or discharge was obtained during the year under review, the following are given where available: table of daily water level or discharge; summary of monthly and annual data; and descriptive information about the gaging station. Descriptive information tells which stations are international gaging stations, the type of gage used, location, drainage area, data contributor, whether the flow is natural or regulated, gage datum, and any unusual conditions which may occur at a station. Revisions or corrections to previously published data are included. The overall accuracy or the degree of reliability of hydrometric data depends upon the type of gage, gage stability, accuracy of observation of stage, measurement of reference datum, stability of stage-discharge relationship, and computation procedures and interpretation of records. All published daily discharge, water level and sediment data are available in metric units on microfiche. (Geiger-PTT)
W86-03235

AUSTIN, TEXAS, FLOOD OF MAY 24-25, 1981,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-03260

MORPHOLOGICAL MODELLING FOR RIVERS WITH NON-UNIFORM SEDIMENT,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W86-03269

MANITOBA: SURFACE WATER DATA, 1984,
Inland Waters Directorate, Ottawa (Ontario).
1985. 175 p.

Descriptors: *Stream gages, *Hydrologic data collections, *Hydrometric stations, *Discharge measurement, *Surface water, Gaging, Gaging stations, Gages, Fluvial sediments, Hydrometry, Data collections, Discharge hydrographs, Flow discharge, Surveys, *Canada, *Manitoba.

The results of the hydrometric survey studies which were made in Mannitoba by the Water Survey of Canada for 1984 are presented. For gaging stations where a systematic record of water level or discharge was obtained, data on the daily water level or discharge, monthly and annual data, and descriptive information about the sampling site are given. Waters adjacent to an international boundary contain records approved jointly by both the United States and Canada. A number of revisions that have been made to previously published data are included. The overall accuracy or the degree of reliability of hydrometric data included in this report depends upon the type of gage, stability of the gage, accuracy of observation of stage and measurement of reference datum. The degree of reliability also depends upon the stability of the stage-discharge relationship, the frequency and accuracy of discharge measurements, and the computation procedures and interpretation of records. All published daily discharge, water level, and sediment data are available in metric units on microfiche. (Geiger-PTT)
W86-03287

ALTERNATIVE FOR CHARACTERIZING STREAM SIZE,
Corvallis Environmental Research Lab., OR.
R. M. Hughes, and J. M. Omernik.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 87-101, 2 fig, 1 tab, 71 ref.

Descriptors: *Stream classification, *Stream order, Stream discharge, Flow discharge, Watersheds, Hydrologic cycle, Hydrologic cycle, Hydraulic geometry, Hydrologic models.

There are disadvantages to using stream order to compare streams and watershed size on a regional or national scale because of the lack of uniform map specifications, lack of agreement on definition of a first-order stream, and the problem of deciding the appropriate map scale to determine stream order. To overcome these problems, an alternative technique for the characterization of stream size was explored. Seventy-one watershed/stream ecosystems in 31 states within major physiographic and climatic regions of the conterminous United States were examined. The objective was to demonstrate the value of using discharge characteristics and watershed area instead of stream order to provide a rough but useful characterization of watershed and stream sizes throughout the nation. The authors found that streams of a given order show vast ranges in discharges and watershed area, greatly overlapping the ranges for lower and higher order streams. Therefore, they suggest using mean annual discharge per unit area and watershed area instead of stream order to quantify stream and watershed size. (Author)
W86-03380

SIGNIFICANCE OF FLOODPLAIN SEDIMENTS IN NUTRIENT EXCHANGE BETWEEN A STREAM AND ITS FLOODPLAIN,

East Carolina Univ., Greenville, NC. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-03385

ORGANIC CARBON SUPPLY AND DEMAND IN THE SHETUCKET RIVER OF EASTERN CONNECTICUT,
East Carolina Univ., Greenville, NC. Dept. of Biology.
E. A. Matson, and R. L. Klotz.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 247-269 p, 3 fig, 4 tab, 64 ref.

Descriptors: *Aquatic environment, *Organic carbon, *Lotic environment, Organic matter, Microbial studies, Nutrients, Controlled streams, Aquatic productivity, Productivity, Shetucket River, Connecticut.

Autochthonous and allochthonous supplies of organic carbon were compared in the Shetucket River of eastern Connecticut during 1974. The biomass of the sixth-order river segment was dominated by epilithic, unicellular algae, and heterotrophic activity was at least 75% microbial. Imported and exported dissolved organic carbon was measured, and gross primary production and total community respiration were estimated. Light-limited in situ gross primary production (2000 kcal/sq m/yr) provided the equivalent of 40% of the carbon respired in the river segment, and calculated net primary production (60% of gross) supplied about 14% of the calculated carbon assimilated by heterotrophs. Even though primary production was two orders of magnitude greater than in small, shaded New England brooks, total community respiration was only twice as great. The supply of allochthonous carbon per square meter of river bottom was at least 400,000 times greater than autochthonous production per square meter, and total carbon import and export were equal. (Author)
W86-03387

AQUATIC MACROPHYTE CONTRIBUTION TO THE NEW RIVER ORGANIC MATTER BUDGET,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
B. H. Hill, and J. R. Webster.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 273-282 p, 1 fig, 4 tab, 29 ref.

Descriptors: *Aquatic environment, *Lotic environment, *Aquatic macrophytes, *Organic matter, New River, Virginia, Periphyton, Model studies, Cycling nutrients, Organic carbon, Detritus.

Recent studies of energy flow in lotic ecosystems indicate that streams are strongly dependent on watershed-derived organic matter. However, appreciable in situ production of organic matter can occur under favorable conditions of insolation and nutrient availability, especially in higher order streams. This paper reports on studies estimating the relative contribution of aquatic macrophytes to the organic matter budget of the New River. Production rates were measured by the harvest method and extrapolated to the entire reach on the basis of measurements of cover made by aerial photography. The estimated macrophyte contribution was compared with measurements of periphyton production and model estimated allochthonous inputs. Macrophytes contributed 13.1% of the total input and 28% of the input generated within the reach. Macrophyte input to the New River trophic dynamics occurs as an autumnal pulse of rapidly decomposed detritus. This pulse forms an important link between spring-summer periphyton production and fall-winter allochthonous-based production. (Author)
W86-03388

PRIMARY PRODUCTION AND DECOMPOSITION OF SUBMERGENT AND EMERGENT AQUATIC PLANTS OF TWO APPALACHIAN RIVERS,
North Texas State Univ., Denton. Inst. of Applied Sciences.
For primary bibliographic entry see Field 5C.
W86-03389

BIOTIC INTERACTIONS OR ABIOTIC LIMITATIONS. A MODEL OF LOTIC COMMUNITY STRUCTURE,
Cornell Univ., Ithaca, NY. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W86-03390

DYNAMICS OF LEAF PROCESSING IN A MEDIUM-SIZED RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-03393

ROLE OF SHREDDERS IN DETRITAL DYNAMICS OF PERMANENT AND TEMPORARY STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-03394

MICROBIAL ACTION IN DETRITAL LEAF PROCESSING AND THE EFFECTS OF CHEMICAL PERTURBATION,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5C.
W86-03395

CHARACTERIZATION OF THE KINETICS OF 'DENITRIFICATION' IN STREAM SEDIMENTS,
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 5C.
W86-03397

2F. Groundwater

SIMULATED GROUND-WATER FLOW IN THE POTOMAC AQUIFERS, NEW CASTLE COUNTY, DELAWARE,
Geological Survey, Towson, MD. Water Resources Div.
M. M. Martin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4007, 1984. 85 p, 58 fig, 1 plate, 4 tab, 20 ref.

Descriptors: *Groundwater flow, *Simulation analysis, Confined aquifers, Aquifer characteristics, *Delaware, Coastal plain aquifers, Finite-difference model.

Flow in three aquifers of the Potomac Formation in New Castle County, Delaware, was simulated. Results of the calibrated flow model show the maximum transmissivity of the lower aquifer is between 1,000 and 1,500 square feet per day; the middle aquifer, between 3,000 and 3,500 square feet per day; and the upper aquifer, between 5,000 and 6,000 square feet per day. Vertical leakance values for the three confining beds are similar and range 1 x 10 to the (1-8) power per day in downdip areas and .01 per day in subcrop areas. A storage coefficient of 0.00056 was used for each aquifer. A specific storage value of 0.000006 per foot was used for each confining bed. Estimated storage coefficients were not changed during calibration. Changes in water levels resulting from five scenarios of future pumpage were evaluated. Results of these simulations show: (1) the reduction in pumpage at Amoco causing a 120 foot local recovery of heads; (2) water levels generally will change less than 25 feet if there is no change in pumpage; (3) proposed pumpage in western Delaware may cause drawdowns below the tops of the aquifers; and (4) expected increases in pumpage would cause the greatest head decline, about 40 feet, in the lower aquifer at Getty. (USGS)
W86-02920

GEOHYDROLOGY OF THE MADISON AND ASSOCIATED AQUIFERS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
J. S. Downey.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Professional Paper 1273-G, 1984. 47 p, 44 fig, 2 tab, 112 ref.

Descriptors: *Geohydrology, *Aquifer systems, *Simulation models, Flow systems, Montana, North Dakota, South Dakota, Wyoming, *Hydrogeology, Model studies, Saline water, Water quality, Paleozoic aquifers, Ground-water flow systems, Madison Limestone, *Northern Great Plains.

The ground-water system in the Northern Great Plains can be subdivided into at least five major regional aquifers. Two of these are discussed in this report--the Madison aquifer of Mississippian age and the Cambrian-Ordovician aquifer, which includes the Red River Formation. These aquifers are recharged in high areas of Montana and Wyoming and in the Black Hills of South Dakota. Regional flow is generally to the east and northeast, with most of the discharge from the system occurring in eastern North Dakota and in the Canadian Province of Manitoba. High-density brine occurs in both aquifers on the eastern flank of the Williston basin, and freshwater flow appears to divert to the north and south around the brine area or to leak upward into aquifers overlying the Madison. Fracture systems traverse the entire geologic section and exert a major influence on both vertical and horizontal flow. Prior to Pleistocene glaciation, the flow system probably was similar to that which exists today. During the Pleistocene Epoch, ice sheets covered the northern and eastern parts of the study area causing extensive changes in recharge and discharge patterns. These changes probably did not cause major shifting in the position of the high-density brines. The flow system was analyzed with the help of a three-dimensional mathematical simulation. (USGS)
W86-02921

WATER-SUPPLY POTENTIAL OF THE FLORIDAN AQUIFER IN OSCEOLA, EASTERN ORANGE, AND SOUTHWESTERN BREVARD COUNTIES, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
M. Planert, and W. R. Aucott.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4135, 1985. 69 p, 35 fig, 5 tab, 30 ref.

Descriptors: *Groundwater availability, *Model studies, Areal hydrogeology, *Florida, Areal assessment, Floridan aquifer, *Water supply potential.

The city of Melbourne and adjacent areas in south Brevard County obtain their water supply from Lake Washington. As of 1982, the lake could provide a maximum of 15 million gallons per day but the projected need for the year 2000 is nearly three times that amount. As one alternative for a future water supply, this study investigated with a digital model, the potential yields of well fields completed in the Floridan aquifer. Seven pumping schemes were simulated with the digital model. Each simulation was made under steady-state conditions so that storage properties of the ground-water system were not included. The most advantageous area for ground-water development was in central Osceola County. Poor quality of water precluded locating a well field within Brevard County. If the ground-water alternative is chosen for the future supply, an observation well network is advisable to monitor head changes; chloride concentration trends east of the pumping centers; and chloride concentration trends in zones below the pumped zone. (USGS)
W86-02924

ESTIMATION OF VERTICAL HYDRAULIC CONDUCTIVITY OF THE CLAY LAYER BETWEEN THE EUTAW AND GORDO AQUIFERS IN THE VICINITY OF FAUNSDALE, MARENGO COUNTY, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
M. Planert, and A. K. Sparks.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4083, 1985. 23 p, 19 fig, 1 tab, 4 ref.

Descriptors: *Groundwater, *Confined aquifers, *Confining beds, Aquicludes, Groundwater movement, Groundwater management, Groundwater availability, *Alabama, Marengo County.

The vertical hydraulic conductivity of the confining bed between the Eutaw and Gordo aquifers in the vicinity of Faunsdale, in northeast Marengo County, Alabama, is 1x10(-5) foot per day or less. Modeling vertical conductivities larger than 1x50(-5) foot per day produced drawdowns in the Eutaw aquifer greater than those observed in a test where 750 gallons per minute were pumped from the Gordo aquifer. Modeling has shown that vertical hydraulic conductivity of the confining bed is the controlling factor on the drawdown in the Eutaw aquifer. At equilibrium (steady-state) pumping 750 gallons per minute there was 3 feet of drawdown in the Eutaw aquifer with a confining bed conductivity of 1x10(-5) foot per day. When the conductivity was decreased to 1x10(-6) foot per day drawdown in the Eutaw aquifer was only 0.35 foot. A conductivity of 1x10(-5) foot per day in the 48-hour simulation reproduced the drawdown in the well from the 48-hour pumping test, but the conductivity may be as small as an untested 1x10(-6) foot per day. (USGS)
W86-02925

MODEL PROJECTIONS, 1980-99, FOR ARKANSAS RIVER VALLEY, HAMILTON AND KEARNY COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
L. E. Dunlap, R. J. Lindgren, and J. E. Carr.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4082, 1984. 168 p, 28 fig, 2 tab, 6 ref.

Descriptors: *Computer models, River regulations, *Surface-groundwater relations, Leakage, *Finite element method, Model studies, *Arkansas River, Hamilton County, Kearny County, *Kansas.

A study was made, in cooperation with the Kansas State Board of Agriculture, to determine the effects that additional ground-water development would have on streamflow and water levels on an area along the Arkansas River in Hamilton and Kearny Counties, southwestern Kansas. A computer model was used to simulate the changes in streamflow and water levels from 1980 through 1999. Six pumpage options were tested using variations in pumpage rate and number of wells pumping in the model area. If the full amount appropriated by water rights were pumped rather than actual 1979 conditions of pumpage, annual pumpage would be reduced 24 percent, but net annual river loss would be reduced only 1 percent. A pumpage increase of approximately 19 percent over 1979 pumpage conditions would cause an increase of net annual river loss from 5 to 9 percent. Increased pumpage, in the form of additional wells in the model area, would cause additional ground water to be removed from storage in the aquifer and an increase in net annual river loss. (USGS)
W86-02928

HYDROLOGY OF AREA 61 NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02934

RECONNAISSANCE STUDY OF SALTWATER CONTAMINATION IN THE EL DORADO AQUIFER, UNION COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02936

HYDROGEOLOGIC DATA FROM A TEST WELL IN EAST-CENTRAL DUVAL COUNTY, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-02938

HYDROLOGIC EFFECTS OF IMPOUNDMENTS IN SHERBURNE NATIONAL WILDLIFE REFUGE, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
R. G. Brown.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4175, 1984. 20 p, 8 fig, 5 tab, 10 ref.

Descriptors: *Impoundments, *Groundwater movement, Surface water, *Water quality, *Surface-groundwater relationships, Sherburne National Wildlife Refuge, *Minnesota, Sherburne County.

The hydrologic effects of proposed impoundments in Sherburne National Wildlife Refuge were found to be insignificant with respect to both ground- and surface- water flow patterns and water quality. Monitoring of water levels in 23 observation wells and of discharge in the St. Francis River during 1980 and 1981 has shown that ground water in the surficial aquifer responds quickly to areal recharge and subsequently discharges to the St. Francis River. The impoundment of surface water in the refuge was not found to affect water levels in the refuge significantly. The impoundments may affect ground-water-flow systems beneath and adjacent to the impoundments. Quality of ground and surface water was found to be similar except ground water contained higher concentrations of dissolved nitrite plus nitrate nitrogen than surface water. Phytoplankton removed dissolved nitrite plus nitrate nitrogen from surface water. The effects of impoundments on water quality are expected to be minor. (USGS)
W86-02939

SURFICIAL AQUIFER IN PINELLAS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
K. W. Causseaux.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4289, 1985. 26 p, 9 fig, 4 tab, 38 ref.

Descriptors: *Water quality, *Water supply, *Groundwater, Water table aquifer, Well field, Drawdown, Well drilling, Pinellas County, *Florida.

The surficial aquifer in Pinellas County, Florida, contains potable water throughout most of the county and is a potential source of water to augment the public supply that is presently imported from adjacent counties. The county accounts for 38 percent of the public supply consumption of ground water in the 11-county area of west-central Florida and 68 percent of this water is imported from two adjacent counties. The surficial aquifer has a saturated thickness of more than 30 feet throughout most of the county. Specific capacity per foot of screen for wells is less than 0.1 gallon per minute per foot of drawdown in some parts of the county, but yield is sufficient in most of the county for many small uses with shallow-well pumps. Minimum potential yield varies from 5 gallons per minute in the northern part of the county to more than 30 gallons per minute in the south. Concentrations of iron are high enough in parts of the county to cause staining. Chloride concentrations are less than 100 milligrams per liter in most of the county and do not pose a problem for many uses. (USGS)
W86-02946

GROUND-WATER SYSTEM AND SIMULATED EFFECTS OF GROUND-WATER WITHDRAWALS IN NORTHERN UTAH VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. W. Clark.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4007, 1985. 56 p, 27 fig, 7 tab, 10 ref.

Descriptors: *Groundwater, *Model studies, *Utah, Groundwater, Recharge, Groundwater movement, Discharge, Potentiometric levels, Great Basin, Utah Valley, *Simulation analysis, *Withdrawals.

The effects of withdrawals from the principal ground-water reservoir in northern Utah Valley, Utah, were projected by means of a three-dimensional, finite-difference, digital-computer model, which was constructed to study and simulate the ground-water system. The model was calibrated against (1) water levels measured in 1947, which were assumed to represent steady-state conditions; (2) observed water-level changes from 1947-83 for transient-state conditions; and (3) the results of an aquifer test. The calibrated model was used to simulate varying quantities of ground-water withdrawal and recharge and to estimate water-level changes for 1980-2000. The average annual rate of recharge for the area is assumed to be 190,000 acre-feet per year, and the average annual discharge from wells at the end of transient-state calibration was assumed to be 50,100 acre-feet per year. Water-level declines of as much as 25 feet are projected for the 20-year period if the average recharge rate is assumed and the discharge from wells is as much as 91,400 acre-feet per year. During transient-state calibration, changes in recharge to the principal ground-water reservoir were shown to be a major cause of the variations in water levels. (USGS)
W86-02948

FEASIBILITY OF ARTIFICIAL RECHARGE IN THE COASTAL PLAIN NEAR ATLANTIC CITY, NEW JERSEY, WITH EMPHASIS ON THE 800-FOOT SAND OF THE KIRKWOOD FORMATION,
Geological Survey, Trenton, NJ. Water Resources Div.
J. E. May.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4063, 1985. 24 p, 5 fig, 2 tab, 27 ref.

Descriptors: *Artificial recharge, *Recharge wells, Aquifer management, Groundwater availability, Atlantic Coastal Plain, *New Jersey, Atlantic City, Kirkwood Formation, Kirkwood-Cohansey aquifer system.

Renewed development of the Atlantic City area since the mid-1970's has increased the demand for water. Increased pumpage from the 800-foot sand of the Kirkwood Formation has reversed an antecedent water-level recovery in this aquifer, thus reducing water in storage and increasing the potential for saltwater intrusion. Practicable approaches to providing a dependable water supply while properly managing withdrawals from the 800-foot sand include development of surface- and groundwater supplies but artificial recharging the 800-foot sand is the principal alternative discussed. Investigation of its feasibility locally included a review of methods of artificial recharge and attendant operational problems, investigation of local hydrogeologic conditions, and collection and interpretation of water-quality data. System design and quality of

injected water are important for successful artificial recharge. Mixtures of water from the 800-foot sand and from a representative local public-supply system may become supersaturated with oxygen. Significant temperature differences between two such waters would likely exacerbate that condition. Limited chemical analyses suggest that suspended solids concentration of water from local public supplies may at times be high enough to cause clogging of recharge-well screens. These problems are soluable by appropriate conditioning of recharge water. (USGS)
W86-02949

DESCRIPTION OF AQUIFER UNITS IN WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
W. D. McFarland.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 82-165, 1983. 35 p, 13 fig, 5 tab, 84 ref.

Descriptors: *Groundwater, *Aquifer evaluation, *Dissolved solids, Underground waste disposal, *Aquifer delineation, *Aquifer characteristics, *Oregon, Groundwater quality, Underground injection control.

Hydrogeologic information for western Oregon was compiled to aid the U.S. Environmental Protection Agency in evaluating proposals for underground injection of waste fluid. Geologic formations were grouped into seven aquifer units according to hydraulic and geologic similarities. The bedrock aquifer units in the Klamath Mountains, Coast Range, and Western Cascade Range all have low permeabilities and yield only small quantities of water to wells for domestic and stock uses. The Columbia River Basalt Group aquifer unit, which crops out along the Columbia River and the northern Willamette Valley, also has overall low permeability; however, the basalt supplies water for public, domestic, and stock, and some irrigation uses in western Oregon. The most important aquifer unit, and generally most permeable is the Tertiary-Quaternary sedimentary deposits that occur in lowlands throughout the area and provide water for irrigation, industry, public supplies and domestic and stock uses. All aquifer units generally contain water with low concentrations of dissolved solids at shallow depths. In the Tertiary marine rocks of the Coast Range, analyses from a limited number of deep wells indicated that water with more than 10,000 milligrams per liter dissolved solids is widespread at depths greater than about 2,000 feet. (USGS)
W86-02950

PROJECTED WATER-LEVEL DECLINES IN THE OGALLALA AQUIFER IN LEA COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. P. McAda.
Available from OFSS, USGS, Box 25424 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4062, 1984. 84 p, 49 fig, 14 tab, 26 ref.

Descriptors: *Computer models, Mathematical models, Model studies, *Groundwater depletion, Groundwater availability, Groundwater storage, Water table decline, *New Mexico, Lea County, High Plains, *Ogallala aquifer.

A two-dimensional digital ground-water flow model was constructed of the Ogallala aquifer in Lea County, New Mexico. Simulations of predevelopment steady-state and historical pumping conditions were used to fit the model. Projections of water-level declines were made based on the condition of no additional development and the condition of a 0.44 percent annual increase in irrigation withdrawals to 1990 and a 0.88 percent annual increase in nonirrigation withdrawals to 2020. Based on no additional development, projected maximum water-level declines from 1980 were 31 feet in 2000 and 59 feet in 2020. The amount of recoverable water remaining in the aquifer as simulated by the model was 24.6 million acre-feet in 2000 and 22.4 million acre-feet in 2020, compared to an estimated 28 million acre-feet in 1980, with increased withdrawals, projected maximum declines were 33 feet in 2000 and 67 feet in 2020. As simulated by the model, 24.4 million acre-feet of recoverable water remained in 2000 and 21.8 million acre-feet remained in 2020. The sensitivity of the model to variation in hydraulic conductivity, specific yield, and recharge was tested over their range of uncertainty. Projected water-level declines were most sensitive to specific yield. In response to changes in specific yield, declines varied by as much as 6.2 feet from the standard simulation to 2020 with no additional development. (USGS)
W86-02952

APPLICATION OF THE CONJUGATE-GRADIENT METHOD TO GROUND-WATER MODELS,
Geological Survey, Denver, CO. Water Resources Div.
T. A. Manteuffel, D. B. Grove, and L. F. Konikov.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4009, 1983. 24 p, 4 fig, 1 tab, 9 ref.

Descriptors: *Groundwater, *Mathematical models, Model studies, Numerical analysis, *Simulation analysis, Matrix solution method, Conjugate gradient method.

The conjugate-gradient method can solve efficiently and accurately finite-difference approximations to the ground-water flow equation. An aquifer-simulation model using the conjugate-gradient method was applied to a problem of ground-water flow in an alluvial aquifer at the Rocky Mountain Arsenal, Denver, Colorado. For this application, the accuracy and efficiency of the conjugate-gradient method compared favorably with other available methods for steady-state flow. However, its efficiency relative to other available methods depends on the nature of the specific problem. The main advantage of the conjugate-gradient method is that it does not require the use of iteration parameters, thereby eliminating this partly subjective procedure. (USGS)
W86-02954

DISTRIBUTION AND SOURCE OF BARIUM IN GROUND WATER, CATTARAUGUS INDIAN RESERVATION, SOUTHWESTERN NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
R. B. Moore, and W. W. Staubitz.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. Water-Resources Investigations Report 84-4129, 1984. 17 p, 4 fig, 4 tab, 15 ref.

Descriptors: Groundwater, Water quality, *Barium, Sulfate, Hydrogen sulfide, *Groundwater quality, Barite, Bedrock aquifer, *New York, Cattaraugus Indian Reservation, Sulfate bacteria, Potable water.

High concentrations of dissolved barium have been found in ground water from bedrock wells on the Seneca Nation of Indians Reservation on Cattaraugus Creek in southwestern New York. Concentrations in 1982 were as high as 23.0 milligrams per liter, the highest found reported from any natural ground-water system in the world. The highest concentrations are in a bedrock aquifer and in small lenses of saturated gravel between bedrock and the overlying till. The bedrock aquifer is partly confined by silt, clay, and till. The high barium concentrations are attributed to dissolution of the mineral barite ($BaSO_4$), which is present in the bedrock and possibly in overlying silt, clay, or till. The dissolution of barite seems to be controlled by action of sulfate-reducing bacteria, which alter the $BaSO_4$ equilibrium by removing sulfate ions and permitting additional barite to dissolve. Ground water from the surficial, unconsolidated deposits and surface water in streams contain little or no barium. Because barium is chemically similar to calcium, it probably could be removed by cation exchange or treatments similar to those used for water softening. (USGS)
W86-02955

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART II, GEOHYDROLOGIC MAPS OF THE TERTIARY AQUIFERS AND RELATED CONFINING LAYERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4135, 1984. 6 p, 8 fig, 1 tab, 19 ref.

Descriptors: *Hydrologic maps, *Geohydrologic units, Geologic units, *Aquifers, Confining beds, *Hydrogeology, Northern Louisiana salt-dome basin, *Louisiana, Vacherie salt dome, Cockfield aquifer, Sparta aquifer, Wilcox-Carrizo aquifer.

Regional geohydrologic maps show the altitude of the base and the thickness of the aquifers of Tertiary age and related confining layers in the northern Louisiana salt-dome basin. The limit of freshwater in aquifers is also shown. The basin has an area of about 3,000 square miles, and four geologic units of Tertiary age contain regional aquifers. From oldest (deepest) to youngest, the aquifers are in the Wilcox Group, Carrizo Sand, Sparta Sand, and Cockfield Formation. As the Wilcox is hydraulically interconnected with the overlying Carrizo, they are treated as one hydrologic unit, the Wilcox-Carrizo aquifer. The aquifers are separated by confining layers that retard water movement. In the northwestern part of the area, the Wilcox-Carrizo aquifer is separated from the underlying sand facies of the Nacatoch Sand (Cretaceous age) by a confining layer composed of the Midway Group (Tertiary age) and the underlying Arkadelphia Marl and an upper clay and marl facies of the Nacatoch Sand (both of Cretaceous age). In the remainder of the area, the Wilcox-Carrizo aquifer is separated from an underlying Cretaceous aquifer comprised of the Tokio Formation and Brownstown Marl by the Midway Group and several underlying Cretaceous units which in order of increasing age are the Arkadelphia Maril, Nacatoch Sand, Saratoga Chalk, Marlbrook Marl, and Annona Chalk. The Wilcox-Carrizo aquifer is separated from the Sparta aquifer by the overyling Cane River Formation. The Sparta aquifer is separated from the Cockfield aquifer by the overlying Cook Mountain Formation. (USGS)
W86-02956

AVAILABILITY OF GROUND WATER IN THE OUTWASH AQUIFER, MARION COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
B. S. Smith.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4144, 1983. 70 p, 23 fig, 6 tab, 27 ref.

Descriptors: *Aquifer characteristics, Computer models, *Groundwater availability, Groundwater budget, Hydraulic conductivity, *Hydrologic models, *Water-table aquifers, Withdrawals, Digital models, Effective recharge, *Groundwater flow, Groundwater pumpage, *Indiana, Marion County, *Outwash aquifer, Stream-aquifer connection, *Surface-groundwater relationships, White River.

The outwash aquifer in Marion County, Indiana is a continuous, unconfined sand and gravel deposit containing isolated boulder, till, silt, and clay deposits along the White River, Fall Creek, and Eagle Creek. Flow in the aquifer is from the boundaries of the aquifer with the Tipton till plain toward the streams and major pumping centers in the aquifer. A two-dimensional, finite-difference model of the outwash aquifer was calibrated to water levels of October 6 to 10, 1980 and used to estimate availability of water in the aquifer. A

drawdown limit of 50-percent saturated thickness applied to 78 simulated-pumping wells assumed to be 1 foot in diameter produced 97 cubic feet per second from the outwash aquifer. Streamflow reductions caused by 97 cubic feet per second simulated pumpage and constant-flux boundaries were estimated to be 85 cubic feet per second in the White River and 12 cubic feet per second in Fall Creek. In comparison, the 7-day, 10-year low flows were 83 cubic feet per second in the White River near Nora and 23 cubic feet per second in Fall Creek at Millersville. Simulated pumpage of 115 cubic feet per second and constant-flux boundaries produced streamflow reductions of 101 cubic feet per second on the White River and 13 cubic feet per second on Fall Creek. (USGS)
W86-02958

HYDROLOGY OF AREA 45, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, MONTANA AND NORTH DAKOTA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02959

PRELIMINARY EVALUATION OF HYDROLOGY AND WATER QUALITY IN RELATION TO THE TACOMA LANDFILL, PIERCE COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02961

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE HORSE CREEK AREA, SHERIDAN AND MOORHEAD COAL FIELDS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02968

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, 1970,
Geological Survey, Garden City, KS. Water Resources Div.
M. E. Pabst, and L. E. Stullken.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 82-448, 1982. 1 p (map), 3 fig, 10 ref.

Descriptors: *Water table, *Potentiometric level, *Groundwater, Unconfined aquifers, Underflow, Underground storage, Water-bearing formations, *Kansas, High Plains.

The High Plains aquifer in Kansas is a part of a regional system that extends from South Dakota to Texas. The aquifer in Kansas underlies an area of 31,000 square miles in the western and south-central part. This aquifer is a hydraulically connected assemblage of unconsolidated water-bearing deposits of Tertiary and Quaternary age. Maps published at a scale of 1:500,000 show the altitude and configuration of the water table in Kansas during 1970. Ground water moved from higher altitudes in the western part of the High Plains to lower altitudes in the eastern part under an average gradient of 10 feet per mile. The upgradient flexure of water-table contours along some of the valleys indicates that ground water was discharged to the streams in those areas. (USGS)
W86-02970

CONCEPTUAL HYDROLOGIC MODEL OF FLOW IN THE UNSATURATED ZONE, YUCCA MOUNTAIN, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02974

CORRELATION OF PALEOSTRUCTURE AND SEDIMENT DEPOSITION IN THE MADISON LIMESTONE AND ASSOCIATED ROCKS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, WYOMING, AND NEBRASKA,
Geological Survey, Lakewood, CO. Water Resources Div.
D. L. Brown, R. K. Blankennagel, L. M. MacCary, and J. A. Peterson.
Available from Dist. Branch, USGS 604 S. Pickett St., Alexandria, VA 22034. USGS Professional Paper 1273-B, 1984. 24 p, 3 fig, 34 pl, 1 tab, 39 ref.

Descriptors: *Structural geology, Geological units, *Facies(Sedimentary), *Porosity, Sedimentary basins, *Carbonate rocks, Hydrogeology, Aquifers, Paleogeography, *Paleostructure, Marker beds, Thickness(Sedimentary rocks), *Northern Great Plains.

The present demand for energy has created interest in the Fort Union coal region of the Northern Great Plains. Extensive development of this coal will place an intense demand on the region's limited water resources. Water from Paleozoic rocks might supply a significant part of the required water. The area of greatest interest for evaluation of ground-water potential is in and near the Powder River basin and near the Black Hills. Paleostructural elements have affected the thickness, rock facies, and distribution of porosity in all of the Paleozoic and Mesozoic rocks studied. Major structural elements, such as the Transcontinental arch, Alberta shelf, and Canadian Shield have affected sediment deposition continuously for long intervals of geologic time, while smaller elements, like the Lake Basin fault and Weldon-Brockton fault trends have operated intermittently for long intervals of time. Some paleostructural elements were of limited duration and may appear one time in the geologic record. Knowledge of the relation between paleostructures an sediment thickness, porosity, and facies is useful for predicting the location and water-bearing potential of aquifers in the study area. (USGS)
W86-02977

SELECTED TEST-WELL DATA FROM THE MX-MISSILE SITING STUDY, TOOELE, JUAB, MILLARD, BEAVER, AND IRON COUNTIES, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02980

POTENTIOMETRIC SURFACE AND WATER QUALITY IN THE PRINCIPAL AQUIFER, MISSISSIPPIAN PLATEAUS REGION KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
R. O. Plebuch, R. J. Faust, and M. A. Townsend.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4102, 1985. 45 p, 14 fig, 5 tab, 41 ref.

Descriptors: *Groundwater movement, *Water quality, *Karst hydrology, Carbonate rocks, Water level, Groundwater recharge, Water levels, *Groundwater levels, *Kentucky.

The Mississippian Plateaus region is the outcrop area of rocks of Mississippian age which extends as a broad arcuate band around the Western Coal Field in westcentral Kentucky. Much of the area is characterized by plains of low relief containing numerous sinkholes, subsurface drainage, and a low density of surface streams. The principal aquifer consists of a thick sequence of limestones extending downward stratigraphically from the base of the Chesterian Series to the black shales at the top of the Devonian rocks. Well yields range from several gallons per minute to as much as 500 gallons per minute in some karst areas where secondary openings are well developed. The potentiometric map indicates that ground-water movement generally conforms to the surface drainage pattern. The actual direction of movement varies from river basin to river basin. Most water from the principal aquifer is a calcium magnesium bicarbonate type and is generally good relative to current drinking water standards. The lower St Louis Limestone, in places, yields a calcium magnesium sulfate water that is corrosive and has a strong hydrogen sulfide odor. The karst areas of the principal aquifer are vulnerable to contamination because of the well-developed subsurface drainage. Urban areas, industries, and agriculture are sources of contaminants that can be easily flushed into the ground-water system. (USGS)
W86-02983

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, SEPTEMBER 1984,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02985

GEOHYDROLOGY OF THE VALLEY AQUIFER IN THE COHOCTON AREA, UPPER COHOCTON RIVER, STEUBEN COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02987

SYNOPSIS OF SALTWATER INTRUSION IN DADE COUNTY, FLORIDA, THROUGH 1984,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02988

HAZARDOUS WASTE RESEARCH, PENSACOLA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02989

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02991

STREAMFLOW AND BASIN CHARACTERISTICS AT SELECTED SITES IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02993

QUANTITATIVE ANALYSIS OF THE HYDROTHERMAL SYSTEM IN LASSEN VOLCANIC NATIONAL PARK AND LASSEN KGRA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. L. Sorey, and S. E. Ingebritsen.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4278, 1984. 87 p, 17 fig, 4 tab, 21 ref.

Descriptors: *Geothermal studies, *Numerical modeling, *Thermal springs, *Lassen Volcanic National Park, *California, Groundwater, Hydrothermal systems.

The conceptual model of the Lassen system is termed a liquid-dominated hydrothermal system with a parasitic vapor-dominated zone. The essential feature of this model is that steam and steam-heated discharge at relatively high elevations in Lassen Volcanic National Park (LVNP) and liquid discharge with high chloride concentrations at relatively low elevations outside LVNP are both fed

by an upflow of high-enthalpy two-phase fluid within the Park. Liquid flows laterally away from the upflow area towards the areas of high-chloride discharge, and steam rises through a vapor-dominated zone to feed the steam and steam-heated features. Numerical simulations show that several conditions are necessary for the development of this type of system, including (1) large-scale topographic relief, (2) an initial period of convective heating within an upflow zone followed by some change in hydrologic or geologic conditions that initiates drainage of liquid from portions of the upflow zone, and (3) low permeability barriers that inhibit the movement of cold water into the vapor zone. Simulations of thermal fluid withdrawal south of LVNP, carried out in order to determine the effects of such withdrawal on portions of the hydrothermal system within the Park, showed decreases in pressure and liquid saturation beneath the vapor zone which result in a temporary increase and subsequent decrease in the rate of upflow of steam. (USGS)
W86-02994

HYDROGEOLOGY OF THE CLAYTON AQUIFER OF SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, R. E. Faye, and R. Brooks.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. Georgia State Hydrologic Atlas 13, 1984. 89 p, 30 fig, 5 tab, 37 ref.

Descriptors: *Georgia, *Hydrogeology, *Groundwater, Subsurface mapping, Aquifer characteristics, Potentiometric level, Water-level fluctuations, Chemical analyses, Water use, Well drilling, Groundwater divide, Clayton aquifer, Chattahoochee River, Flint River, Ocmulgee River, *Georgia.

The Clayton aquifer of southwest Georgia consists of limestone and calcareous sand of Paleocene age and ranges in thickness from about 10 to 265 feet. Estimated transmissivities range from 400 feet squared per day in Dougherty County to 11,000 feet squared per day in Randolph and Terrell Counties. During 1980, an estimated 20 million gallons per day was pumped from the Clayton aquifer. The greatest pumpage was in the Dawson and Albany areas where, by 1981, water levels in the Clayton aquifer had declined below predevelopment levels by as much as 150 and 175 feet, respectively. The rate of decline accelerated after 1976, corresponding to a significant increase in irrigation pumping throughout the study area. The aquifer is recharged by precipitation in the northeast-trending outcrop belt, by leakage from the underlying Providence aquifer and overlying Wilcox confining zone downdip, and through idle multiaquifer wells. Declining water levels in the Clayton aquifer have increased the potential for leakage from the overlying and underlying units. Constituent concentrations in water from the Clayton aquifer generally do not exceed drinking water standards. Exceptions are high concentrations of iron in Randolph County and possibly high dissolved constituent concentrations in the vicinity of the Gulf Trough. (USGS)
W86-02995

WATER-LEVEL HYDROGRAPHS FOR OBSERVATION WELLS IN VIRGINIA, 1982,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02996

DESCRIPTION AND SOME HYDROGEOLOGIC IMPLICATIONS OF CORES FROM THE RADIOACTIVE WASTE MANAGEMENT COMPLEX, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5E.
W86-02999

GROUND-WATER DEVELOPMENT ALTERNATIVES IN THE CHIPUXET GROUND-WATER RESERVOIR, RHODE ISLAND,
Geological Survey, Providence, RI. Water Resources Div.
H. E. Johnston, and D. C. Dickerman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4254, 1985. 100 p, 24 fig, 16 tab, 54 ref.

Descriptors: *Manganese, *Nitrates, *Hydrologic models, Groundwater, Low flow, Groundwater recharge, Induced recharge, Glacial aquifers, Groundwater budget, Transmissivity, Well yield, Water yield, *Groundwater quality, *Rhode Island.

A glacial sand and gravel aquifer in the Chipuxet River basin of Rhode Island forms a ground-water reservoir that could yield as much as 8.6 million gallons per day to wells; however, some streams would go dry for extended periods of time. The State Water Resources Board has tested five site that it proposes to develop for a public supply of 3 million gallons per day. A digital model was used to determine how withdrawal at this rate from alternative combinations of wells would affect water levels and streamflow. Results show that withdrawal of 3 million gallons per day would have a minimal effect on water levels, but that withdrawal at this rate from some well combinations could cause the Chipuxet River to have little or no flow for 90 consecutive days on the average of 1 year in 20. Quality of ground water is generally good, but leaching of fertilizers applied to croplands, which overlie much of the aquifer, has caused locally excessive concentrations of nitrate. Induced infiltration of surface water through organic sediments that line the bottoms of ponds and streams also seems to be the cause of elevated concentrations of manganese in water from some heavily pumped wells. (USGS)
W86-03001

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, ASH-FLOW TUFF, AND LAHARIC BRECCIA, BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03005

BOUGUER GRAVITY ANOMALY MAP OF THE TWENTYNINE PALMS MARINE CORPS BASE AND VICINITY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03006

EFFECT OF EUSTATIC SEA-LEVEL CHANGES ON SALTWATER-FRESHWATER RELATIONS IN THE NORTHERN ATLANTIC COASTAL PLAIN,
Geological Survey, Trenton, NJ. Water Resources Div.
H. Meisler, P. P. Leahy, and L. L. Knobel.
Available from Dist. Branch, USGS 604 S. Pickett St. Alexandria, VA 22304. USGS Water-Supply Paper 2255, 1984. 28 p, 17 fig, 2 tab, 44 ref.

Descriptors: Brines, Chlorides, Coastal Plains, Computer models, Continental Shelf, Continental Slope, *Geochemistry, Geohydrology, *Saline-Freshwater Interfaces, Saltwater, Sea Level, Seawater, Simulation, Transition Zone, *Saline Water Instrusion, *Atlantic Coastal Plain, Delaware River estuary, New Jersey, North Carolina, Pleistocene, Virginia.

A finite-difference computer model was used to analyze the effect of eustatic sea-level changes on the development of the transition zone between fresh ground water and underlying saltwater in the northern Atlantic Coastal Plain. The model simulates, in cross section, the sedimentary wedge from the Delaware River estuary in New Jersey to the Continental Slope. Simulated steady-state freshwater flow is separated from static saltwater by a sharp interface. The model was used to test the sensitivity of the simulated interface position to anisotropy as well as to sea-level elevation. Increasing anisotropy causes the interface to be shallower and extend farther offshore. Lowering sea level causes the interface to be deeper and to extend farther offshore. Simulations using hydraulic conductivities based on available data suggest that the transition zone is not in equilibrium with present sea level. The position of the transition zone probably reflects a long-term average sea level of between 50 and 100 ft below present sea level. The cyclic movement of salty ground water in response to sea-level fluctuations during the Quaternary and Late Tertiary caused the saltwater to mix with freshwater, thus producing a broad transition zone. The freshwater is predominantly sodium bicarbonate in character. The saltwater, from New Jersey to Virginia, probably is a sodium calcium chloride brine. In North Carolina, it is primarily seawater. (USGS)
W86-03010

HYDROGEOLOGIC DATA RELATED TO THE POTENTIAL FOR STOCK-WATER DEVELOPMENT ON FEDERALLY OWNED RANGELAND NEAR DILLON, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03016

GEOHYDROLOGY OF ROCKS PENETRATED BY TEST WELL UE-25PNO1, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
R. W. Craig, and J. H. Robinson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4248, 1984. 57 p, 30 fig, 5 tab, 23 ref.

Descriptors: *Groundwater, *Aquifer testing, *Aquifer characteristics, Pumping tests, Hydrogeology, Dual porosity, Nevada Test Site, *Nevada, Nye County.

Test well UE-25pNo1 was drilled in cooperation with the U.S. Department of Energy in the southwestern part of the Nevada Test Site, for investigations related to the isolation of high-level nuclear wastes. Rocks penetrated in the well are predominantly ash-flow tuffs of Tertiary age to a depth of 1,244 meters and dolomite of Paleozoic age to a total depth of 1,805 meters. Hydraulic head is 20 meters higher in the Paleozoic dolomite than in most of the Tertiary tuffs; this hydraulic-head difference indicates a major hydrologic barrier to the downward movement of fluid. Any vertical fluid movement from the Tertiary to the Paleozoic sections would be small, as would be movement from the Paleozoic rocks into the Tertiary rocks. In the Tertiary section, an interval of less than 30 meters in the upper Prow Pass Member of Crater Flat Tuff has an apparent transmissivity of 14 meters squared per day. In the Paleozoic section, an interval of less than 22 meters has an apparent transmissivity of 69 meters squared per day. Compositions of water from the Tertiary and Paleozoic sections are similar to regional waters from rocks of the same ages. (USGS)
W86-03024

WATER-RESOURCES APPRAISAL OF THE UPPER ARKANSAS RIVER BASIN FROM LEADVILLE TO PUEBLO, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03025

COMPILATION OF GROUND WATER QUALITY DATA IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03026

POTENTIOMETRIC SURFACES ON LONG ISLAND, NEW YORK–A BIBLIOGRAPHY OF MAPS,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03030

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO 1983,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03031

EFFECTS OF ARTIFICIAL RECHARGE ON AN ALLUVIAL AQUIFER, OGALLALA FORMATION, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03032

PRINCIPLE OF SUPERPOSITION AND ITS APPLICATION IN GROUND-WATER HYDRAULICS,
Geological Survey, Reston, VA. Water Resources Div.
T. E. Reilly, O. L. Franke, and G. D. Bennett.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-459, 1984. 36 p, 16 fig, 7 ref.

Descriptors: *Drawdown, *Groundwater, Hydaulics, Hydrogeology, *Groundwater hydraulics, Groundwater movement, *Superposition.

The principle of superposition, a powerful methematical technique for analyzing certain types of complex problems in many areas of science and technology, has important application in groundwater hydraulics and modeling of ground-water systems. The principle of superposition states that solutions to individual problems can be added together to obtain solutions to complex problems. This principle applies to linear systems governed by linear differential equations. This report introduces the principle of superposition as it applies to groundwater hydrology and provides background information, discussion, illustrative problems with solutions, and problems to be solved by the reader. (USGS)
W86-03040

HYDROGEOLOGIC FRAMEWORK FOR THE SAND AQUIFER OF THE SOUTHEASTERN UNITED STATES COASTAL PLAIN,
Geological Survey, Atlanta, GA. Water Resources Div.
R. A. Renken.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4243, 1984. 26 p, 11 fig, 8 pl, 3 tab, 116 ref.

Descriptors: *Coastal aquifers, *Sand aquifers, *Areal hydrogeology, Geohydrologic units, *Coastal plains, *Hydrogeologic framework, *Regional aquifer system, South Carolina, Georgia, Alabama, Mississippi.

Tertiary and Cretaceous age sand aquifers of the southeastern United States Coastal Plain constitute a distinct multistate hydrogeologic regime informally defined as the southeastern sand aquifer. Seven regional hydrogeologic units are defined; four regional aquifer units and three regional confining beds. Sand aquifers of this system consist of quartzose, feldspathic, and coarse to fine sand and sandstone and minor limestone; confining beds are composed of clay, shale, chalk, and marl. Three hydrogeologic units of Cretaceous to Holocene age overlie the sand system: the surficial aquifer, upper confining unit, and Floridan aquifer system. These three units are not part of the southeastern sand aquifer, but are an integral element of the total hydrogeologic system, and some act as a source of recharge to, or discharge from the underlying clastic sediments. Low-permeability strata of Paleozoic to early Mesozoic age form the base off the total system. (USGS)
W86-03041

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF PRAIRIE DU CHIEN-JORDAN, AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. F. Ruhl, R. J. Wolf, and D. G. Adolphson.
Available from the OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4045, 1983. 2 p, 15 fig, 2 tab, 16 ref.

Descriptors: *Aquifer characteristics, Water quality, *Underground waste disposal, *Hydrogeology, *Groundwater quality, Path of pollutants, Water pollution sources, Hollandale embayment, Prairie du Chien-Jordan aquifer, *Minnesota.

The Prairie du Chien-Jordan aquifer is part of a sequence of sedimentary bedrock units in southeast Minnesota. The Jordan Sandstone is a white to yellow, fine- to coarse-grained sandstone. The Prairie du Chien Group comprises two dolomitic formations, which are vuggy and fractured and interbedded with thin layers of shale. The aquifer was deposited from Paleozoic seas that occupied the Hollandale embayment. The surface of the aquifer dips toward the interior of the embayment where it is as deep as 750 feet below land surface and as thick as 500 feet. Permeability is secondary in the Prairie du Chien Group because of solution cavities and fractures and is intergranular in the Jordan Sandstone. Water in the aquifer is confined and generally flows to the north and east into the Minnesota and Mississippi Rivers. A ground-water divide separates part of the flow southward into Iowa. This aquifer supplies more water than any other in the State. Quality of water is generally good throughout the aquifer. Calcium magnesium bicarbonate type water is most common. The potential for contamination from surface sources is low except near the Mississippi River valley, where the overlying drift is thin. The most serious water-quality problem is contamination by chemical wastes in St. Louis Park. (USGS)
W86-03042

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON, COS., TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff, C. W. Bonnet, and L. S. Coplin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. Texas Department of Water Resources, Austin, Report 285, 1984. 219 p, 2 fig, 8 tab, 3 ref.

Descriptors: *Texas, *Groundwater data, *Data collections, Groundwater, Drillers' logs, Water levels, Chemical analyses, Water quality, Water levels.

Information on major new water wells in Harris and Galveston Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the ground-water resources which have been published previously. (USGS)
W86-03045

GROUND-WATER LEVELS IN WYOMING, 1974 THROUGH 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
J. O. Ragsdale, and C. B. Oberender.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-403, 1985, 194 p, 163 fig, 20 tab, 8 ref.

Descriptors: *Hydrographs, *Groundwater, *Observation wells, Water-level recorders, *Groundwater data, Hydrologic data, Data collections, *Wyoming.

Ground-water levels are measured periodically in a network of about 270 observation wells in Wyoming, mostly in areas where ground water is used in large quantities for irrigation or municipal purposes. The program is conducted by the U.S. Geological Survey in cooperation with the Wyoming State engineer and the Wyoming Department of Economic Planning and Development. This report contains hydrographs for most observation wells showing water-level fluctuations from 1974 through 1983. Also included in the report are maps showing locations of observation wells and tabulations of well depths, use of water, geologic source, records available, and highest and lowest water levels for the period of record. (USGS)
W86-03046

PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION, FOR PUERTO RICO AND THE U.S. VIRGIN ISLANDS,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 10C.
W86-03047

VALIDITY OF DARCY'S LAW UNDER TRANSIENT CONDITIONS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03049

MEASUREMENT OF GROUND-WATER VELOCITY USING RHODAMINE WT DYE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
G. Garklavs, and L. G. Toler.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-856, 1985. 14 p, 4 fig, 4 tab, 2 ref.

Descriptors: *Groundwater movement, *Waste disposal, *Tracers, *Radioactive waste disposal, *Path of pollutants, *Illinois, Groundwater flow, Environmental tracers.

Ground-water flow velocity was estimated in a tract of land adjacent to a low-level radioactive-waste disposal site near Sheffield, Illinois, by measuring the time-of-travel between two wells spaced 110 feet apart. Rhodamine WT dye was the principal tracer used in the test. The leading edge and peak concentrations of Rhodamine WT were well defined. A ground-water velocity of 6.9 feet per day (2,500 feet per year) was computed from the arrival time of the leading edge of the tracer cloud. (USGS)
W86-03051

DATA COLLECTION FOR A TIME-OF-TRAVEL AND DISPERSION STUDY ON THE COOSA RIVER NEAR CHILDERSBURG, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
R. A. Gardner.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-411, 1985. 61 p, 5 fig, 2 tab, 3 ref.

Descriptors: *Dye dispersion, *Flow rates, Surface water, *Streamflow, *Coosa River, Childersburg, *Alabama, *Time-of-Travel.

Approximately 2,300 dye-tracer samples were collected and analyzed during a 5-day time-of-travel study on a 23-mile reach of the Coosa River between Logan Martin and Lay dams near Childers-

burg, Alabama, October 27 to 31, 1984. Rhodamine WT was used as the tracer-dye. Unsteady flow conditions prevailed in the study reach. The rate of movement of the dye cloud between sampling cross sections ranged from 0.15 to 1.36 feet per second. The average rate of movement of the dye cloud between the injection cross section and the downstream sampling cross section was 0.42 foot per second. (USGS)
W86-03052

DEFINITION OF BOUNDARY AND INITIAL CONDITIONS IN THE ANALYSIS OF SATURATED GROUND-WATER FLOW SYSTEMS--AN INTRODUCTION,
Geological Survey, Reston, VA. Water Resources Div.
O. L. Franke, T. E. Reilly, and G. D. Bennett.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-458, 1984. 26 p, 11 fig, 1 tab, 11 ref.

Descriptors: Groundwater, Hydraulics, *Boundary conditions, Mathematical analysis, *Aquifer systems, *Groundwater movement, *Model studies, *Initial conditions.

Accurate definition of boundary and initial conditions is an essential part of conceptualizing and modeling ground-water flow systems. This report explains the properties of the seven most common boundary conditions encountered in ground-water systems and discusses major aspects of their application. It also discusses the significance and specification of initial conditions and evaluates some common errors in applying this concept to ground-water system models. (USGS)
W86-03053

WATER-RESOURCES MONITORING IN THE COTTONWOOD CREEK AREA, SHASTA AND TEHAMA COUNTIES, CALIFORNIA, 1982-83,
Geological Survey, Sacramento, CA. Water Resources Div.
R. P. Fogelman, and K. P. Evenson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4187, 1985. 70 p, 9 fig, 6 tab, 12 ref.

Descriptors: *Groundwater, Water quality, *Groundwater levels, Surface water, Dams, *Surface-groundwater relationships, Tehama County, Shasta County, Cottonwood Creek, *California, *Monitoring.

The Cottonwood Creek study area in the Redding basin, California, contains a network of wells established to provide baseline information on ground-water levels and quality prior to the completion of two proposed dams, one on Cottonwood Creek and one on South Fork Cottonwood Creek. Analysis of monthly ground-water levels from September 1982 through September 1983 shows lowest water levels in autumn and highest in spring. The ground-water surface slopes east and has a mound at Anderson-Cottonwood Irrigation District Canal near the town of Cottonwood. Future studies here could provide additional information needed for subsequent modeling studies. Data are insufficient upstream from the damsites, specifically in areas of future impoundment where the monitoring network could be expanded. Comparison of ground-water quality samples collected from periods of lowest and highest water levels showed little chemical variation. Ground water is good to excellent with respect to recommended drinking-water standards. Ground-water types north of Cottonwood Creek are sodium magnesium or magnesium sodium bicarbonate and south of Cottonwood Creek are calcium magnesium or magnesium calcium bicarbonate. Surface-water samples from Cottonwood and South Fork Cottonwood Creeks indicate water chemically similar to ground water south of Cottonwood Creek. (USGS)
W86-03054

IMPACTS OF THE TAMPA BYPASS CANAL SYSTEM ON THE AREAL HYDROLOGY, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03056

PROPOSED ARTIFICIAL RECHARGE STUDIES IN NORTHERN QATAR,
Geological Survey, Orlando, FL. Water Resources Div.
J. O. Kimrey.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-343, 1985. 31 p, 6 fig, 6 ref.

Descriptors: *Hydrogeology, *Groundwater recharge, *Geologic formations, *Injection, Desalination, *Aquifer testing, Water utilization, *Water management(Applied), *Qatar, Rus Formation, Umm er Radhuma Formation, Doha, Artificial recharge.

The aquifer system in northern Qatar comprises a water-table aquifer in the Rus Formation which is separated by an aquitard from a partially confined aquifer in the top of the overlying Umm er Radhuma Formation. These two aquifers are composed of limestone and dolomite of Eocene and Paleocene age and contain a fragile lens of freshwater which is heavily exploited as a source of water for agricultural irrigation. Net withdrawals are greatly in excess of total recharge, and quality of ground water is declining. Use of desalinated seawater for artificial recharge has been proposed for the area. Artificial recharge, on a large scale, could stabilize the decline in ground-water quality while allowing increased withdrawals for irrigation. The proposal appears technically feasible. Recharge should be by injection to the Umm er Radhuma aquifer whose average transmissivity is about 2,000 meters squared per day (as compared to an average of about 200 meters squared per day for the Rus aquifer). Implementation of artificial recharge should be preceded by a hydrogeologic appraisal. These studies should include test drilling, conventional aquifer tests, and recharge-recovery tests at four sites in northern Qatar. (USGS)
W86-03058

TEST WELLS IN CENTRAL WASHINGTON, 1977-79: DESCRIPTION AND RESULTS,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, and D. R. Cline.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4259, 1985. 77 p, 16 fig, 7 tab, 16 ref.

Descriptors: *Aquifer characteristics, Basalts, Observation wells, Water table, Deep wells, Aquifers, Chemical quality, *Aquifer testing, *Columbia River Basalt Group, *Washington.

During the period October 1977-March 1979, four wells were added to a network of wells in central Washington State to provide information on potential sources of ground-water supplies from aquifers in the Columbia River Basalt Group and supplemental ground-water data for water-management purposes where they cannot be obtained by other means. Two were drilled in the Yakima River canyon between Ellensburg and Yakima--one to 602 feet in the Burbank Creek valley and the other to 1,019 feet near the mouth of Umtanum Creek. A third well was drilled to 725 feet in the Badger Pocket area of the Ellensburg-Kittitas valley. A test well near George, Washington, was deepened from 975 to 1,610 feet and three piezometers were installed in this interval. The Burbank Creek, Umtanum Creek, and George test wells are completed in basalts and associated interflow zones of the Yakima Basalt Subgroup of the Columbia River Basalt Group. The Badger Pocket well penetrated more than 725 feet of unconsolidated materials without reaching the basalt. Specific capacities of the Umtanum Creek and George wells after 20 hours of pumping were 190 and 160 to 190 gallons per minute per foot of drawdown, respectively. Specific capacity of the Burbank Creek well after flowing for 24 hours was 32.5 gallons per minute per foot of drawdown. The Badger Pocket well was not tested for water yield. (USGS)
W86-03062

SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE UNITED STATES DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY-FISCAL YEAR 1984, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03067

SELECTED HYDROGEOLOGIC DATA FOR THE BIG MUDDY CREEK VALLEY NEAR PLENTYWOOD, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03068

PLANNING REPORT FOR THE WESTERN GULF COAST REGIONAL AQUIFER SYSTEM ANALYSIS, GULF OF MEXICO COASTAL PLAIN, UNITED STATES,
Geological Survey, Austin, TX. Water Resources Div.
H. F. Grubb.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4219, 1984. 30 p, 4 tab, 53 ref.

Descriptors: *Project planning, *Scheduling, *Aquifer systems, *Coastal aquifers, *Computer models, Geohydrologic units, Water quality, Regional aquifer-system, *Gulf Coastal Plain, Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Missouri, Tennessee, Texas.

Large quantities of water for municipal, industrial and agriculture use are supplied from the aquifers in Tertiary and younger sediments over an area of about 225,000 square miles in the coastal plain of Alabama, Arkansas, Florida, Illinois, Kentucky, Louisiana, Mississippi, Missouri, Tennessee, and Texas. Three regional aquifer systems, the Mississippi Embayment aquifer system, the Coastal Lowlands aquifer system, and the Texas Coastal Uplands aquifer system have been developed to varying degrees throughout the area. A variety of problems have resulted from development such as movement of the saline-freshwater interface into parts of aquifers that were previously fresh, lowering of the potentiometric surface with resulting increases in pumping lift, and land-surface subsidence due to the compaction of clays within the aquifer. Increased demand for ground water is anticipated to meet the needs of urban growth, expanded energy development, and growth of irrigated agriculture. The objectives, plan and organization of study of these problems are described in this report and the major tasks to be undertaken are outlined. (USGS)
W86-03069

GROUND-WATER RESOURCES OF BOTTINEAU AND ROLETTE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
P. G. Randich, and R. L. Kuzniar.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. North Dakota State Water Commission County Ground-Water Studies 35, North Dakota Geological Survey Bulletin 78, 1984. 41 p, 14 fig, 5 tab, 52 ref.

Descriptors: *Groundwater, *Aquifers, Transmissivity, Recharge, Water use, *Chemical properties, Potential yield, Storage, Bottineau County, Rolette County, *North Dakota.

Large quantities of water can be obtained from glacial-drift aquifers in Bottineau and Rolette Counties. These aquifers underlie about 317 square miles and contain approximately 762,000 acre-feet of available ground water. Potential well yields range from less than 50 to 1,000 gallons per minute.

The water generally is a mixed type. The dominant cations are calcium and sodium and the dominant anions are bicarbonate and sulfate. The Hell Creek and Fox Hills aquifers, which consist of very fine to medium-grained sanstone beds are the major bedrock aquifers. Wells developed in these aquifers generally yield less than 50 gallons per minute. The water is a sodium chloride or sodium sulfate type and generally contains more dissolved solids than water from glacial-drift aquifers. The population of Bottineau and Rolette Counties depends on ground water as a source of water supply. (USGS)
W86-03075

GROUND-WATER RESOURCES OF THE MATTAPOISETT RIVER VALLEY, PLYMOUTH COUNTY, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03079

GROUND-WATER QUALITY APPRAISAL OF SURFICIAL SAND-PLAIN AQUIFERS IN HUBBARD, MORRISON, OTTER TAIL, AND WADENA COUNTIES, MINNESOTA,
Geological Survey, Grand Rapids, MN. Water Resources Div.
C. F. Myette.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4080, 1984. 49 p, 22 fig, 9 tab, 27 ref.

Descriptors: *Groundwater appraisal, *Water quality, Sand aquifers, Statistical analysis, Solute transport, Hubbard County, Morrison County, Otter Tail County, Wadena County, Staples, *Minnesota, Pollutant identification.

Water samples were collected periodically from 124 wells completed in sand-plain aquifers in Hubbard, Morrison, Otter Tail, and Wadena Counties, Minnesota, during a 3-year study that began in October 1979. The study determined baseline groundwater quality, provided data for evaluation of trends, and investigated seasonal variations in concentration of selected chemical constituents. The ground water is predominately a calcium bicarbonate type with low to moderate concentrations of dissolved solids (77 to 710 milligrams per liter), and is chemically suitable for most uses. In local areas, concentrations of nitrogen, iron, and manganese exceed limits recommended by the Minnesota Pollution Control Agency for drinking water. Comparison to historical data indicates a trend towards local degradation of ground-water quality, which is attributed to the accumulation of nitrogen within and immediately downgradient from several major agricultural areas. Seasonal and annual variations in concentrations of some chemical constituents are related to ground-water-level fluctuations caused by recharge. At the Staples Irrigation Center near Staples, Minnesota, concentrations of nigrogen, chloride, and iron differ significantly with depth, which suggests local chemical stratification within the aquifer at least several hundred feet downgradient from the Center. The stratification exists throughout annual cycles, and is most pronounced during periods of little recharge (winter months). (USGS)
W86-03080

APPARENT WATER RESISTIVITY, POROSITY, AND WATER TEMPERATURE OF THE MADISON LIMESTONE AND UNDERLYING ROCKS IN PARTS OF MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
L. M. MacCary.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Professional Paper 1273-D, 1984. 14 p, 25 fig, 1 tab, 13 ref.

Descriptors: Energy, Fuels, *Water quality, *Porosity, Geothermal studies, Groundwater utilization, Permeability, *Saline water - freshwater interfaces, Montana, Nebraska, North Dakota, Wyoming, *Apparent water resistivity, Porosity logs, Resistivity logs, *Thermal gradient, *Northern Great Plains.

The need for large quantities of energy has created interest in the Fort Union coal region of the Northern Great Plains. Extensive development of this coal will place an intense demand on the region's limited water resources. Water from Paleozoic rocks might supply, at least temporarily, a significant part of the required water. The quality of water in the Paleozoic rocks was estimated by an apparent water resistivity (Rwa) calculation using resistivity and porosity curves recorded on geophysical logs. Rwa is used to determine the areal distribution of fresh and salty water and the probable direction of water movement. The largest Rwa occurs in the recharge areas and the smallest occurs in the areas of dense brine in the Williston basin. The brine areas are not in the deepest part of the basn, but are shifted to the east and south owing to the hydrodynamic effects of less salty water moving around the brine. The coolest ground-water temperatures occur in the recharge areas and the hottest temperatures are in the deep basins. Thermal gradients, determined from well temperatures, indicate how the rocks function as either insulators or conductors of heat. (USGS)
W86-03081

GEOHYDROLOGIC SECTIONS, NORTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03083

HYDROGEOLOGIC APPRAISAL OF FIVE SELECTED AQUIFERS IN ERIE COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
T. S. Miller, and W. W. Staubitz.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4334, 1985. 89 p, 26 fig, 10 tab, 22 ref.

Descriptors: *Glacial aquifers, *Water quality, *Groundwater movement, Well data, *New York, Erie County, Onondaga Limestone, Landfills, Carbonate aquifer.

Hydrogeologic conditions and water quality at four stratified-drift aquifers and a bedrock (Onondaga Limestone) aquifer were investigated by the U.S. Geological Survey in cooperation with the Erie County Department of Environment and Planning. The Clarence-Lancaster-Newstead area includes two aquifers--one is a complex of morainal, beach, and outwash sand and gravel; the second is the underlying production aquifer in Onondage Limestone. Most wells tap the limestone aquifer. Water quality is suitable for most uses in both aquifers except for road-salt contamination at shallow wells near the New York State Thruway. A landfill on the aquifer has affected the water quality in some areas along its perimeter. The Sardinia and Springville areas each include an aquifer consisting of surficial outwash sand and gravel ranging in thickness from less than 10 feet to 95 feet. Several deeper water-bearing zones occur within till and lacustrine deposits 400 to 600 feet thick in the valleys. Ground water moves from the north and from the aquifer's edges to the center of the valley and discharges into the main streams in the middle of the valley and to springs along the southern edge of the aquifers. Water quality is generally suitable for most uses. A landfill adjacent to the Sardinia aquifer has not significantly affected the aquifer. The Alden area includes an aquifer that consists of two sand and gravel zones separated by 10 to 20 feet of clay or till. The more productive lower zone has mineralized water derived from underlying shale. (USGS)
W86-03084

ALTITUDE OF WATER TABLE, SURFICIAL AQUIFER, PALM BEACH COUNTY, FLORIDA, APRIL 24-26, 1984,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03085

GRAVITY SURVEY AND DEPTH TO BEDROCK IN CARSON VALLEY, NEVADA-CALIFORNIA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 8E.
W86-03087

GEOHYDROLOGY OF THE AQUIFER IN THE SANTA FE GROUP, NORTHERN WEST MESA OF THE MESILLA BASIN NEAR LAS CRUCES, NEW MEXICO,
Geological Survey, Las Cruces, NM. Water Resources Div.
R. G. Myers, and B. R. Orr.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4190, 1985. 37 p, 13 fig, 6 tab, 20 ref.

Descriptors: *Groundwater, *Alluvial aquifers, *Groundwater movement, Water quality, Drilling, Well logs, *New Mexico, Dona Ana County, Las Cruces, Mesilla Basin, West Mesa.

Because of the heterogeneity of the Santa Fe Group, New Mexico, the hydrologic characteristics of the aquifer vary substantially from place to place. Hydraulic conductivities of 12 and 30 feet per day were estimated from aquifer tests for two wells in the eastern one-half of the study area. Well yields in the western one-half of the study area generally are less than 5 gallons per minute. Some of the well yields in the eastern one-half of the study area are greater than 1,000 gallons per minute. Ground water flows southeastward across the western one-half of the study area at a gradient of about 50 feet per mile. Across the eastern one-half of the study area, ground water flows southeastward at a gradient of less than 5 feet per mile. Dissolved-solids concentrations in groundwater range from 906 to 1,470 milligrams per liter in the western one-half of the study area and from 378 to 556 milligrams per liter in the eastern one-half. (USGS)
W86-03088

TEST WELLS T27 AND T28 WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO,
Geological Survey, Las Cruces, NM. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03089

TEST WELLS T23, T29, AND T30, WHITE SANDS MISSILE RANGE AND FORT BLISS MILITARY RESERVATION, DONA ANA COUNTY, NM,
Geological Survey, Las Cruces, NM. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03090

HYDROLOGIC DATA FOR LEVIATHAN MINE AND VICINITY, ALPINE COUNTY, CALIFORNIA, 1981-83,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03091

DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE HOUSATONIC RIVER AND ADJACENT AQUIFER, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03093

GROUNDWATER LEVELS IN NEBRASKA, 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
M. S. Johnson, and D. T. Pederson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. The University of Nebraska-Lincoln, Conservation and Survey Division, Nebraska Water Survey Paper Number 57, 1984. 67 p, 22 fig, 12 tab, 30 ref.

Descriptors: Groundwater, *Hydrographs, Water table, *Observation wells, *Water-level fluctuations.

Summaries are presented of ground-water level changes in Nebraska for the year 1983, both statewide and for major areas where there were significant changes from estimated predevelopment water levels. The amounts of change from predevelopment levels are shown on maps, and hydrographs are used to show trends in water-level changes. Also described are availability of data on water levels, changes in the water-level measurement program during the year, and the two major causes of water-level change--recharge from precipitation and withdrawal of ground water. (USGS)
W86-03094

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1985,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03095

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, SEPTEMBER 1984,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03096

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER SYSTEM IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1984,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03097

TEST WELL DO-CE 88 AT CAMBRIDGE, DORCHESTER COUNTY, MARYLAND,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03098

PROPOSED 10-YEAR PLAN FOR CONTINUATION OF HYDROLOGIC STUDIES OF THE EDWARDS AQUIFER, SAN ANTONIO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
L. F. Land.
Avilable from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-817, 1984. 26 p, 8 fig, 1 tab, 20 ref.

Descriptors: Hydrology, Recharge, Withdrawal, Water level, Water quality, *Hydrogeology, Geohydrology, Aquifers, *Texas, *Groundwater levels, Water balance, *Edwards aquifer.

The importance of the Edwards aquifer as a freshwater resource and its susceptibility to being contaminated, being over utilized, or both resulted in the development of a proposed 10-year plan to monitor and study its hydrology. The plan proposes adjustments to the current monitoring activities of computing and measuring recharge, discharge, withdrawals, water levels, and water quality. To conduct the needed special studies, the plan recognizes the need for the construction and drilling of many new wells at specific locations and to selected depths. Many of the wells will be in clusters so that data can be obtained on a stratigraphic basis. Some of the topics identified for special study include: (1) The potential of saline water entering the freshwater zone from the downdip boundary; (2) the possibility of water leaking into the aquifer from an overlying aquifer; (3) the effects of urbanization on ground-water quality in local areas; (4) the movement and dissipation of a recharge water plume; (5) the influx of water from the Glen Rose Formation; (6) the effects of the fault barriers, regional dense bed, and irregular geologic framework on ground-water flow patterns; (7) natural recharge-discharge relationships; (8) the aquifer stage-storage relationship; (9) natural water-quality evolution; and (10) a refinement of the hydrogeologic framework in a local area. (USGS)
W86-03104

GENERALIZED POTENTIOMETRIC SURFACE OF THE EVANGELINE AND EQUIVALENT AQUIFERS IN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03107

DEVELOPMENT OF A TWO-DIMENSIONAL DIGITAL MODEL FOR THE ANALYSIS OF THE GROUND-WATER FLOW SYSTEM IN THE SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
P. Martin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4340, 1985. 68 p, 17 fig, 9 tab, 14 ref.

Descriptors: *Mathematical model, *Finite difference method, Groundwater basins, Groundwater budget, Least-squares method, San Antonio Creek valley, *California, Santa Barbara County, Barka Slough.

A two-dimensional finite-difference model was used to simulate ground-water flow conditions in San Antonio Creek valley. The model was calibrated to simulate steady-state conditions as approximated by ground-water conditions in 1943 and transient conditions during the period 1944-77. The transmissivity of the aquifer and the vertical hydraulic conductivity of the confining bed underlying Barka Slough at the western edge of the basin were calibrated during the steady-stage simulation. Calibrated transmissivity values ranged from more than 20,000 feet squared per day along the axis of the valley to less than 100 feet squared per day along the perimeter. Net flux values (the difference between recharge and net discharge) along the San Antonio Creek channel were determined during the transient-state simulation by a least-squares calibration technique. Results of the calibration indicated that the net flux out of the system along the stream channel increased by about 4,030 acre-feet per year from 1943 to 1977. The model simulated that about 70 percent of the increase in net flux was derived from the reduction in ground-water discharge to Barka Slough and about 30 percent from water coming out of storage. (USGS)
W86-03108

HYDROGEOLOGIC DATA FROM THE U.S. GEOLOGICAL SURVEY TEST WELLS NEAR WAYCROSS, WARE COUNTY, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
S. E. Matthews, and R. E. Krause.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4204, 1984. 29 p, 10 fig, 7 tab, 25 ref.

Descriptors: *Groundwater, *Carbonate aquifer, Hydrogeology, Water quality, Groundwater geology, *Tertiary limestone aquifer, *Georgia.

Two wells were constructed near Waycross, Ware County, Georgia, from July 1980 to May 1981 to collect stratigraphic, structural, geophysical, hydrologic, hydraulic, and geochemical information for the U.S. Geological Survey Tertiary Limestone Regional Aquifer-System Analysis. Data collection included geologic sampling and coring, borehole geophysical logging, packer testing, water-level measuring, water-quality sampling, and aquifer testing. In the study area, the Tertiary limestone aquifer system is about 1,300 feet thick and is confined and overlain by about 610 feet of clastic sediments. The aquifer system consists of limestone, dolomite, and minor evaporites and has high porosity and permeability. A 4-day continuous discharge aquifer test was conducted, from which a transmissivity of about 1 million feet squared per day and a storage coefficient of 0.0001 were calculated. Water from the upper part of the aquifer is of a calcium bicarbonate type. The deeper highly mineralized zone produces a sodium bicarbonate type water in which concentrations of magnesium, sulfate, chloride, sodium, and some trace metals increase with depth. (USGS)
W86-03113

EFFECTS OF HYDRAULIC BOREHOLE MINING ON GROUND WATER AT A TEST SITE IN NORTHEAST ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03116

GLACIAL AQUIFERS SYSTEMS IN THE NORTHEASTERN UNITED STATES--A STUDY PLAN,
Geological Survey, Albany, NY. Water Resources Div.
F. P. Lyford, J. E. Dysart, A. D. Randall, and A. L. Kontis.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-928, 1984. 33 p, 6 ref, 4 tab, 57 ref.

Descriptors: *Alluvial aquifers, *Aquifer characteristics, Aquifer systems, *Glacial aquifers, Glacial drift, Regional analysis, *Northeast US, Regional aquifer-system analysis, Northeast US Glacial Aquifers.

The U.S. Geological Survey project designed to study the availability and quality of water in glacial aquifers in the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Ohio is scheduled for completion in 1986. It will focus on general principles that define aquifer geometry, hydraulic properties of sediments, recharge, discharge, physical-chemical properties of water, rock and water-rock interactions, and mechanisms for mixing of water from multiple sources. Planned project activities include compilation and analysis of available data for a regionwide analysis of glacial-aquifer systems, studies of selected system components such as recharge and chemical processes, classification of aquifers with regard to water-supply potential, and construction of generalized ground-water models to predict responses of types of aquifer systems to pumping and climatic stress. This report describes the general characteristics of glacial aquifer systems in the Northeastern United States and of planned work elements of the study. (USGS)
W86-03117

IMPACT OF DEVELOPMENT ON AVAILABILITY AND QUALITY OF GROUND WATER IN EASTERN NASSAU COUNTY, FLORIDA, AND SOUTHEASTERN CAMDEN COUNTY, GEORGIA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown.

Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4190, 1984. 113 p, 24 fig, 19 tab, 96 ref.

Descriptors: *Aquifer characteristics, *Artesian wells, *Carbonate rocks, *Confined aquifers, Unconfined aquifers, Connate water, Groundwater movement, *Potentiometric level, Saline-freshwater interfaces, Saline-water intrusion, Floridan aquifer, Surficial aquifer, *Florida, *Georgia, Fernandina Beach.

The primary sources of water in the area are from the surficial and Floridan aquifers. The surficial aquifer, consisting of thin permeable zones of sand, shell, and limestone, provides limited water supplies (10-50 gallons per minute). Its estimated transmissivity ranges from less than 100 to 10,000 feet squared per day. Its water is generally of acceptable quality for most uses, except near the coast. The Floridan aquifer consists of three zones of permeable limestone and dolomite separated by semiconfining beds of hard, massive dolomite and limestone, all of which are confined by leaky confining beds. The upper and middle zones, about 530-1,000 feet and 1,200-1,700 feet below land surface, respectively, have transmissivities ranging from 20,000-50,000 and 40,000-60,000 feet squared per day, respectively. The lower zone, about 2,000-2,100 feet below land surface contains very saline water. Water in the upper zone contains chloride concentrations generally ranging from 20-40 milligrams per liter. In Fernandina Beach, water from a few wells tapping this zone has relatively high chloride concentrations (190 milligrams per liter), probably due to upward migration of saline water from deeper zones through uncased or improperly-plugged well bores and not by lateral intrusion. (USGS)
W86-03119

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03120

GEOHYDROLOGY OF TEST WELL USW-H1, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
F. E Rush, W. Thordarson, and D. G. Pyles.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4032, 1984. 56 p, 21 fig, 15 tab, 25 ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Transmissivity, *Geophysical logging, *Chemical analysis, *Nevada, Crater Flat Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Well USW-H1 is one of several wells drilled in cooperation with the U.S. Department of Energy near the southwestern part of the Nevada Test Site for hydraulic testing, hydrologic monitoring, and geophysical logging. The rocks penetrated by the well to a total depth of 1,829 meters were volcanic tuffs of Tertiary age. The most transmissive zone in this well is in the Prow Pass Member of the Crater Flat Tuff that was penetrated at a depth from 572 to 653 meters; transmissivity is about 150 meters squared per day. The remainder of the rocks penetrated between depths of 653 to 1,829 meters have a transmissivity of about 1 meter squared per day, and are predominantly in the Bullfrog Member of the Crater Flat Tuff in the depths from 736 to 741 meters. The water is a sodium bicarbonate type that is typical of tuffaceous rocks in this area. The water has an apparent age of 12,000 to 13,000 years. (USGS)
W86-03121

POTENTIAL GROUND-WATER LEVEL CHANGES IN THE MISSISSIPPI RIVER ALLUVIAL AQUIFER IN RESPONSE TO PROPOSED NAVIGATION IMPROVEMENTS ON THE YAZOO RIVER IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
A. G. Lamonds, and J. M. Kernodle.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4039, 1984. 65 p, 39 fig, 1 tab, 21 ref.

Descriptors: *Environmental effects, *Inland waterways, *Groundwater, Aquifers, Hydrographs, *Mississippi, *Yazoo navigation study, Yazoo River, Mississippi River alluvial aquifer, Aquifers.

A proposed navigation project on the Yazoo River between Vicksburg and Greenwood, Mississippi, will increase minimum river stages by more than 19 feet at the site of the proposed lock and dam near Vicksburg, and will decrease minimum river stages by 2 to 7 feet in much of the upper reach of the river. Water-level data for 65 observation wells in the alluvial aquifer in the vicinity of the proposed project indicate that post-project minimum ground-water levels in wells very near the river will range from more than 19 feet higher than pre-project minimum levels near Vicksburg to about 7 feet lower than pre-project levels at Greenwood. Post-project ground-water levels will generally be between 15 and 25 feet below land surface during the dry season but will be at or near land surface during the wet season. The change in ground-water levels will decrease with distance from the river but may extend as far as the Bluff Hills to the east and the auxiliary channel or other major drainage features to the west. In the upper reach of the river the decrease in ground-water levels may extend beyond the auxiliary channel to the areas of large ground-water withdrawals several miles to the west of the river. (USGS)
W86-03122

HYDROLOGY OF THE OGALLALA AQUIFER IN FORD COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. M. Spinazola, and M. T. Dealy.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4226, 1983. 58 p, 14 fig, 5 tab, 33 ref.

Descriptors: *Groundwater depletion, *Irrigation requirements, Estimating, *Water quality, *Aquifer management, Ford County, Arkansas River, Crooked Creek-Fowler fault, *Ogallala aquifer, *Kansas, *Withdrawal, Groundwater.

The rapid increase of ground-water withdrawal has caused concern over the future use of the Ogallala aquifer, the principal source of water in Ford County, in southwestern Kansas. Saturated portions of deposits of Tertiary and Quaternary age--excluding the Arkansas River alluvium--form the Ogallala aquifer. Saturated thickness of the Ogallala ranged from 0 to about 350 feet on the downthrown side of the Crooked Creek-Fowler fault and from 0 to about 120 feet on the upthrown side. Ground-water withdrawal was calculated by two methods. The time-discharge method computed withdrawal of about 81,000 acre-feet during 1980 and about 58,000 acre-feet during 1981. The irrigation-requirement method computed withdrawal of about 121,000 acre-feet during 1980 and about 131,000 acre-feet during 1981. Results from the irrigation-requirement method are probably closer to the actual amount of ground-water withdrawal because of problems encountered when applying the time-discharge method. Water-level declines between 1939 and 1981 ranged from about 10 to 50 feet. Water withdrawal from the Ogallala aquifer depleted the volume of water in storage by about 688,000 acre-feet (8 percent) during this same period. If withdrawals continue to the point where the water table drops below the top of the bedrock surface on the upthrown side of the Crooked Creek-Fowler fault, base flow in the Arkansas River could cease. (USGS)
W86-03128

GROUND-WATER-LEVEL TRENDS IN IDAHO, 1971-82,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young, and R. F. Norvitch.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4245, 1984. 28 p, 7 fig, 1 tab, 7 ref.

Descriptors: Wells, *Water-level fluctuations, Groundwater, Groundwater irrigation, Surface-water irrigation, Recharge, Water levels, *Well hydrographs, Water-resources development, *Groundwater depletion, *Idaho, *Groundwater-level trends.

Water-level trends, net water-level changes, and major causes governing these water-level fluctuations are presented for 366 wells in the Idaho statewide observation-well network. Water-level trends were determined for 293 wells. Downward trends in 176 of these wells ranged from less than 1 foot per year to a maximum of 7 feet per year; upward trends in 90 wells ranged from less than 1 foot per year to a maximum of 6 feet per year. Trends were level (no change) in 27 wells. Net water-level changes were determined for 361 wells. Net declines in 269 of these wells ranged from less than 1 foot to a maximum of 52.65 feet; net rises in 92 wells ranged from less than 1 foot to a maximum of 25.12 feet. Significant net water-level declines and downward trends were most apparent in or near areas designated as critical ground-water areas by the Idaho Department of Water Resources. (USGS)
W86-03129

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1984,
Geological Survey, Denver, CO. Water Resources Div.
G. L. Barr, and G. R. Schiner.
USGS Open-File Report 84-620, 1984. 1 map, 2 fig, 2 ref.

Descriptors: *Potentiometric level, *Potentiometric flow, Hydrology, *Hydrogeology, *Maps, *Florida, Southwest Florida Water Management District.

A May 1984 potentiometric surface map of the Southwest Florida Water Management District depicts the annual low water-level period. Water levels in most wells measured in May 1984 were lower than in September 1983. May levels averaged about 1 foot lower than September levels in areas north of latitude 28 07'10" and about 9 feet lower in southern areas. Generally, water levels in May 1984 were lower when compared to May 1983. Water levels in most wells measured in May 1984 averaged less than 1 foot lower than May 1983 levels in the north and about 2 feet lower in the south. (USGS)
W86-03130

GENERALIZED THICKNESS AND CONFIGURATION OF THE TOP OF THE INTERMEDIATE AQUIFER, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Corral, and R. M. Wolansky.
USGS Water-Resources Investigation Report 84-4018, 1984. 1 p, 3 fig, 14 ref.

Descriptors: Hydrology, *Geologic mapping, *Aquifers, Aquifer characteristics, Water quality, *Maps, *Florida, Southwest Florida Water Management District, Intermediate aquifer, Confining beds.

Generalized map show the thickness and top of the intermediate aquifer in west-central Florida within the boundaries of the Southwest Florida Water Management District. The intermediate aquifer consists of a series of water-bearing units and confining beds between the surficial aquifer (water table) and the Floridan aquifer. This aquifer contains from one to several water-bearing units in west-central Florida. The aquifer and confining

beds consist of the Tamiami and Hawthorn Formations of late and middle Miocene age and parts of the Tampa Limestone of early Miocene age. The top of the intermediate aquifer is about 100 feet above sea level in the north and slopes to about 100 feet below sea level in the south. The thickness ranges from zero in the north to more than 600 feet in the south. Despite the high mineral content of the water in some areas, the intermediate aquifer offers the best source of ground water to the coastal and southern areas of west-central Florida. (USGS)
W86-03137

GROUND-WATER DATA FOR GEORGIA, 1983,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, M. F. Peck, S. A. Longsworth, and K. W. McFadden.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-605, 1984. 145 p, 70 fig, 47 tab, 36 ref.

Descriptors: *Groundwater, *Water levels, *Aquifers, *Georgia, *Water quality, *Groundwater levels, Groundwater quality.

Continuous water-level records from 134 wells and more than 700 water-level measurements made in Georgia during 1983 provide the basic data for this report. Selected wells illustrate the effects that changes in recharge and pumping have had on the various ground-water resources in the State. Daily mean water levels are shown in hydrographs for 1983. Monthly means are shown for the 10-year period 1974-83. Mean annual water levels ranged from 9 feet higher to 6 feet lower in 1983 than in 1982. Water-quality samples are collected periodically throughout Georgia and analyzed as part of areal and regional ground-water studies. Along the coast, chloride concentrations in the upper and lower water-bearing zones of the Floridan aquifer system generally remained steady in the Brunswick and Hilton Head Island areas. (USGS)
W86-03139

EVALUATION OF THE EFFECTS OF LAKE AUDUBON ON GROUND- AND SURFACE-WATER LEVELS IN THE LAKE NETTIE AREA, EASTERN MCLEAN COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4242, 1983. 41 p, 19 fig, 7 ref.

Descriptors: *Surface-groundwater relationships, *Groundwater, *Aquifers, Water level, *Hydrographs, *Water-level fluctuations, McLean County, *North Dakota.

Flooding of some roads and agricultural lands has occurred in the Lake Nettie area of eastern McLean County. Part of the flooding was caused by the raising of the level of Lake Audubon to an elevation of 1,848 feet and the construction and filling of the McCluaky Canal. Water levels have risen in the Lake Nettie aquifer as a result of raising the level of Lake Audubon. As of 1982, water levels have risen as much as 4 feet in the lower unit of the Lake Nettie aquifer and between 1 and 2 feet in the upper unit of the Lake Nettie aquifer, which is hydraulically connected to Lake Nettie and Crooked Lake. Water levels have risen in the Turtle Lake aquifer both as a result of raising the water level in Lake Audubon and the filling of McClusky Canal. Water levels have risen as much as 6 feet near the canal, but generally are less than 1 foot higher at distances of about 0.5 mile. (USGS)
W86-03140

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN NORTH DAKOTA,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03144

WATER RESOURCES DATA, ALASKA WATER YEAR 1981.
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03146

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, AND RIO GRANDE BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03147

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03148

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03149

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 1. CENTRAL AND NORTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03150

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 2, SOUTHERN LOUSIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03151

WATER RESOURCES DATA, NEW MEXICO WATER YEAR 1983,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03152

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1982, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03153

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03154

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 2. SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03155

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03156

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 2. LONG ISLAND,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03157

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 3. WESTERN NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03158

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 1, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03159

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 2,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03160

WATER RESOURCES DATA, KENTUCKY WATER YEAR 1983.
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03161

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY FOR THE RICHFIELD 1 DEG. BY 2 DEG. QUADRANGLE AND ADJACENT PART OF SOUTHWESTERN UTAH,
For primary bibliographic entry see Field 7C.
W86-03165

DATA FROM PUMPING AND INJECTION TESTS AND CHEMICAL SAMPLING IN THE GEOTHERMAL AQUIFER AT KLAMATH FALLS, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. M. Benson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-146, 1984. 101 p, 76 fig, 7 tab, 17 ref.

Descriptors: Geohydrology, *Geochemistry, *Temperature, Geothermal resources, Hydrology, Aquifers, Water quality, Pumping, *Injection tests, *Oregon, Klamath Falls, Klamath County.

A seven-week pumping and injection tests in the geothermal aquifer at Klamath Falls, Oregon, in 1983 provided new information on hydraulic properties of the aquifer. The Open-File Data Report on the tests includes graphs of water levels measured in 50 wells, temperature measurement in 17 wells, daily air-temperatures in relation to discharge of thermal water from more than 70 pumped and artesian wells, tables of monthly mean air temperatures and estimates of discharges of thermal water during a normal year, and tables of chemical and isotopic analyses on samples from 12 wells. The water-level measurements reflect the effects of pumping, injection, and recovery over about 1.7 square miles of the hot-well area of Klamath Falls. The pumped well, City Well No 1, and the injection well at the Klamath County Museum are components of a proposed District

Heating Plan. The study was funded principally under contracts from the U.S. Department of Energy to the Lawrence Berkeley Laboratory, Stanford University, and the Oregon Institute of Technology, with coordination and chemical sampling provided under the Geothermal Research Program, U.S. Geological Survey. Support was received from the City of Klamath Falls, Klamath County Chamber of Commerce, Citizens for Responsible Geothermal Development, and many citizen volunteers. (USGS)
W86-03169

GEOHYDROLOGY OF THE NORTHERN PART OF THE TOWN OF BROOKHAVEN, SUFFOLK COUNTY, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
E. J. Koszalka.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4042, 1984. 37 p, 19 fig, 7 tab, 21 ref.

Descriptors: *Geology, Hydrology, *Groundwater, *Aquifers, *Hydraulic properties, Long Island, NY, Town of Brookhaven, Upper glacial aquifer, Magothy aquifer, Lloyd aquifer.

In general, ground water in the area is of suitable quality for drinking and most other uses. Some constituents, however, particularly iron, chloride, and nitrogen, occur locally in unacceptable concentrations. Average hydraulic conductivity ranges from 100 to 300 feet per day (ft/d) in the upper glacial aquifer and from 50 to 70 ft/d in the Magothy aquifer. Transmissivity ranges from 25,000 to 105,000 feet squared per day (ft2/d) in the upper glacial aquifer and from 13,000 to 41,000 ft2/d in the Magothy aquifer. Only sparse data are available for the Lloyd aquifer; average hydraulic conductivity and transmissivity are estimated to be 40 ft/d and 10,000 ft2d, respectively. Precipitation (44.4 inches per year) is the only source of ground water in central and eastern Long Island. In the area studied, about 21.5 inches per year reaches the ground-water reservoir. The remainder is lost to over-land runoff (0.5 inch) and evapotranspiration (22.4 inches). Total public-water-supply pumpage in the area is estimated to be 23.2 million gallons per day. Of this total, 15.8 million gallons per day is withdrawn from the upper glacial aquifer and 7.4 million gallons per day from the Magothy aquifer; the Lloyd aquifer is not used for water supply in the area. (USGS)
W86-03173

INDEX OF HYDROLOGIC DATA FOR SELECTED SITES IN DADE COUNTY, FLORIDA, 1923-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. S. Sonenshein, C. R. Causaras, and J. E. Fish.
USGS Open-File Report 84-430, 1984. 3p (maps), 10 fig, 5 tab, 18 ref.

Descriptors: Hydrology, Geology, *Water quality, *Florida, *Dade County, Surficial aquifers, *Biscayne aquifer.

A comprehensive assessment of the surficial aquifers of southeast Florida, including the Biscayne aquifer, was begun in 1979 by the U.S. Geological Survey, in cooperation with the South Florida Water Management District. In the initial phase of the study, an inventory was made of existing data available in the files of the U.S. Geological Survey and other public agencies of Dade, Broward, and Palm Beach Counties. This report indexes, through tables and maps, the ground-water quality, ground-water level, surface-water stage, and geologic data bases for Dade County. (USGS)
W86-03175

DESCRIPTIVE, GEOLOGIC, AND BOREHOLE GEOPHYSICAL LOGS FOR 23 TEST HOLES IN SOUTH-CENTRAL NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Hiergesell.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-073, 1984. 143p, 3 fig, 17 ref.

Descriptors: *Hydrogeology, *Borehole geophysical logs, Data collection, *Nebraska.

This report presents logs for 23 test holes drilled in eight counties in south-central Nebraska as part of a study of the hydrogeology of the area. Five logs are presented for each of the test holes. The first is a written description summarizing the sediments penetrated during drilling; the second is a geological log providing a diagrammatic representation of the stratigraphic units; the remaining three show spontaneous potential, single-point resistance, and natural-gamma radiation measured in the test holes. The test holes penetrate silts, sands, and gravels of Quaternary age, and siltstones, sandstones, and silts of the Ogallala Formation of Tertiary age. Each test hole was drilled deep enough to penetrate about 20 feet of the underlying Cretaceous-age bedrock. (USGS)
W86-03176

OVERVIEW OF GROUND-WATER QUALITY DATA IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03177

WATER RESOURCES DATA, SOUTH DAKOTA WATER YEAR 1983,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03179

WATER RESOURCES DATA, TENNESSEE WATER YEAR 1983,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03180

WATER RESOURCES DATA, IDAHO WATER YEAR 1983,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03181

WATER RESOURCES DATA, IOWA WATER YEAR 1983,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03182

WATER RESOURCES DATA, KANSAS WATER YEAR 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03183

WATER RESOURCES DATA, GEORGIA WATER YEAR 1983,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03184

WATER RESOURCES DATA, NEW JERSEY WATER YEAR 1983, VOLUME 1: ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03185

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 1: EASTERN NEW YORK EXCLUDING LONG ISLAND,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03186

WATER RESOURCES DATA, ARKANSAS WATER YEAR 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03187

WATER RESOURCES DATA, OREGON, WATER YEAR 1983, VOLUME 2: WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03188

WATER RESOURCES DATA, INDIANA WATER YEAR 1983,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03189

WATER RESOURCES DATA, NEW HAMPSHIRE AND VERMONT WATER YEAR 1983,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03190

WATER RESOURCES DATA, SOUTH CAROLINA WATER YEAR 1983,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03191

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03192

WATER RESOURCES DATA, CALIFORNIA, WATER YEAR 1982, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03193

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03194

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 1. SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.

W86-03195

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 2: ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03196

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 1: ILLINOIS EXCEPT ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03197

WATER RESOURCES DATA, NORTH DAKOTA WATER YEAR 1983,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03198

WATER RESOURCES DATA, NEVADA WATER YEAR 1983,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03199

WATER RESOURCES DATA, OREGON WATER YEAR 1983, VOLUME 1: EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03200

WATER RESOURCES DATA, UTAH WATER YEAR 1983,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03201

WATER RESOURCES DATA, FLORIDA WATER YEAR 1981, VOLUME 4, NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03202

WATER RESOURCES DATA, MAINE WATER YEAR 1982,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03205

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3B: SOUTHWEST FLORIDA GROUND WATER,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03206

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1A: NORTHEAST FLORIDA SURFACE WATER,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03207

WATER RESOURCES DATA, MISSOURI WATER YEAR 1983,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03209

WATER RESOURCES DATA, WYOMING WATER YEAR 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03210

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3A: SOUTHWEST FLORIDA SURFACE WATER,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03211

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1B: NORTHEAST FLORIDA GROUND WATER,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03212

WATER RESOURCES DATA, VIRGINIA WATER YEAR 1983,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03213

WATER RESOURCES DATA, MAINE WATER YEAR 1983,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03214

WATER RESOURCES DATA, WISCONSIN WATER YEAR 1983,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03215

WATER RESOURCES DATA, WEST VIRGINIA WATER YEAR 1983,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03216

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1982,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03218

WATER RESOURCES DATA, MICHIGAN WATER YEAR 1983,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03219

WATER RESOURCES DATA, ALABAMA WATER YEAR 1983,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03220

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03221

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 2: UPPER MISSISSIPPI AND MISSOURI RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03222

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 1. OHIO RIVER BASIN,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03223

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 2. ST. LAWRENCE RIVER BASIN STATEWIDE PROJECT DATA,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03224

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1983,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03225

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1983,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03226

WATER RESOURCES DATA, ARIZONA WATER YEAR 1982,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03227

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 1: HUDSON BAY AND MISSOURI RIVER BASINS,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03228

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 2, COLUMBIA RIVER BASIN,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03229

SIMULATION OF GROUNDWATER FLOW AND CONTAMINANT TRANSPORT USING THE DETERMINISTIC-PROBABILISTIC CONTAMINANT TRANSPORT (DPCT) MODEL,
CGS, Inc., Urbana, IL.
For primary bibliographic entry see Field 5B.
W86-03288

UNDERGROUND RESIDENCE TIMES AND CHEMICAL QUALITY OF BASAL GROUNDWATER IN PEARL HARBOR AND HONOLULU AQUIFERS, O'AHU, HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
T. H. Hufen, P. Eyre, and W. McConachie.
Technical Report No 129, February 1980, 75 p, 28 fig, 5 tab, 1 app, 24 ref.

Descriptors: *Groundwater movement, *Saline water intrusion, *Water quality, *Aquifers, *Hy-

drology, *Pearl Harbor, Honolulu, *Hawaii, Infiltration, Rainfall infiltrtion, Nitrates, Chlorides, Silica, Geohydrology.

Groundwater movement and origin in southern Oahu, Hawaii, were studied by analyzing water samples for carbon-14, carbon-13, tritium, major ions, nitrate, silica, and pH. Striking differences exist among the six basal groundwater systems: Pearl Harbor, Moanalua, Kalihi, Beretania, Moiliili, and Waialae. In Moiliili, Beretania, and Kalihi water residence times are several hundred years, with no measurable water younger than 20 years. This groundwater is derived from rain infiltration in high elevations far inland. Moanalua groundwater varies in isotopic and chemical composition. Some residence times are >950 years, and several regions have water with high chloride levels. Young water is located close to the caprock boundary. Waialae water has residence times <200 years. Little rainfall infitrates from the high elevations. At Pearl Harbor mean residence time is shorter than in the other five regions. Young water, probably from overland infiltration of rain or return irrigation water, is found in the discharge of many sources in the western part of the system.
W86-03290

EVALUATION OF WATER RESOURCES FOR ENHANCED OIL RECOVERY OPERATIONS, CEMENT FIELD, CADDO AND GRADY COUNTIES, OKLAHOMA,
Oklahoma Geological Survey, Norman.
D. A. Preston, W. E. Harrison, K. V. Luza, L. Prater, and R. J. Reddy.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-007713, Price codes: A04 in paper copy, A01 in microfiche. Department of Energy, Washington, DC. DOE/BC/10115-1. February 1982. 64 p, 7 fig, 9 tab, 1 app, 70 ref. DE-AC19-79BC10115.

Descriptors: *Water supply, *Surface water, *Groundwater, Subsurface water, Dissolved solids, *Water quantity, Water quality, *Oklahoma, Oilfield water supply.

The intent of this report is to present a semi-quantitative estimate of the volume deliverability and chemistry of the water potentially available for enhanced oil recovery in the Cement Oil Field. The total storage capacity of impounded water in the reservoirs, lakes, and ponds that lie within the area of study is 362,000 acre-feet. 93.5 percent of this capacity is contained in four reservoirs: Fort Cobb, Ellsworth, Lawtonka and Sprint Creek. The total dissolved solids in the waters impounded in the four reservoirs range from 245 mg/L to 1,948 mg/L. The principal recharging agent for the impounded water is runoff which averages 3.8 in./yr. Groundwater aquifiers included in this report are only those that yield 25 gallons per minute (gpm) or more. The four major aquifiers are the Rush Springs Sandstone, the EL Reno Group, the Arbuckle-Timbered Hills (Cambrian-Ordovician), and the Quaternary deposits. The aquifiers yield from 60 to 150 gpm from the Quaternary to an average of 500 gpm from parts of the Rush Springs. Eliminating water containing above 5,000 mg/L total dissolved solids, the volume of water producible from all aquifiers is estimated at 131 billion barrels. The amount of sub-surface water in place from the formations penetrated by wells drilled within the Cement Field is 41-1/3 billion barrels; 16 1/2 billion from the Permian reservoirs, 25 billion from the pre-Permian reservoirs. Estimates of the water volumes accessible in the four reservoirs are: Rowe sand, 3.3 billion barrels; Niles sand, 2.7 billion barrels; Wade sand, 1.5 billion barrels; Marchand sand, 2.4 billion barrels. A nomograph from which initial open-flow potentials can be estimated after a set of producing parameters is given.
W86-03316

2G. Water In Soils

HYDROLOGIC CHARACTERISTICS OF NEBRASKA SOILS,
Geological Survey, Lincoln, NE. Water Resources Div.
J. T. Dugan.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2222, 1984. 19 p, 4 fig, 12 pl, 13 ref.

Descriptors: *Soil properties, *Soil water movement, Hydrology, *Permeability, Slopes, Water table, Soil classification, Soil genesis, Soil profiles, *Soil physical properties, Soil types, *Hydrologic maps, Soil texture, Available water, Soil surveys, Maps, *Nebraska, *Hydrologic soil groups, Available water capacity, Least permeable horizon, Maximum soil slopes.

Soil characteristics that most affect hydrology in Nebraska are identified and soils of the State are grouped according to those characteristics through use of a 3-digit coding system. The location and extent of the resulting hydrologic soil groups in the State are shown on maps at scales of 1:750,000 and 1:250,000. The interpretation of maps and physical data led to the selection of three chaacteristics as classification variables in grouping the soils: average permeability of the 60-inch soil profile; average maximum soil slope; and depth to the seasonal high water table. Permeability of the least-permeable horizon and available water capacity are given for each soil but are not used as classification variables. U.S. Department of Agriculture Soil Conservation Service general soils maps and data on the physical properties of the soils were well suited to hydrologic interpretation. The basis soil units used in grouping and interpreting the soils were soil associations. Through computer assistance, the 147 soil associations in Nebraska were grouped into 29 hydrologic soil groups and statistics are presented for each group. (USGS)
W86-03028

2H. Lakes

WATER-QUALITY RECONNAISSANCE AND STATISTICAL ANALYSIS FOR SELECTED WATER-SUPPLY LAKES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02927

SURVEY OF FENA RESERVOIR, ISLAND OF GUAM: LIMNOLOGICAL RECONNAISSANCE,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. LaBaugh.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4241, 1985. 17 p, 11 fig, 13 ref.

Descriptors: *Limnology, *Reservoirs, Phosphorus, Nitrogen, Organic carbon, Cations, Anions, Sediment chemistry, Sediments, *Guam, *Fena Reservoir.

During the limnological reconnaissance of Fena Reservoir, samples of the water columns and bottom sediment were obtained and analyzed at five locations within the reservoir. Major ion analyses of filtered surface water indicated that calcium and bicarbonate are the dominant cation and anion in the reservoir. Thermal stratification was recorded at all five locations. Temperature data indicated a distinct hypolimnion at three of the sampling locations below a depth of 8 meters. Vertical profiles of pH exhibited changes with depth as did conductivity. Marked clinograde distributions of dissolved osygen were evident at all but the shallowest locations. Inverse clinograde distributions of total phosphorus, dissolved nitrate plus nitrite and dissolved ammonia were observed at the two deepest stations. Total organic carbon had no distinct profile and had an average concentration of 13.8 milligrams per liter. Data are also provided for nutrient analysis of the sediment. (USGS)
W86-03018

MAY 1984-APRIL 1985 WATER BUDGET OF REELFOOT LAKE WITH ESTIMATES OF SEDIMENT INFLOW AND CONCENTRATIONS OF PESTICIDES IN BOTTOM MATERIAL IN TRIBUTARY STREAMS--BASIC DATA REPORT,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03100

CHLOROPHYLL A CONCENTRATION AND DISTRIBUTION IN TWIN LAKES, COLORADO, PRIOR TO OPERATION OF MT. ELBERT PUMPED-STORAGE POWERPLANT, 1977-81,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
S. G. Campbell, and J. F. LeBounty.
REC-ERC-85-6, January 1985. 42 p, 11 fig, 6 tab, 26 ref, 2 append.

Descriptors: *Oligotrophic lakes, *Chlorophyll, *Primary productivity, *Limnology, *Seasonal variation, *Baseline studies, Pumped storage, Powerplants, Oligotrophy, Phytoplankton, Water quality, Lakes, Mountain lakes.

Studies were performed to identify changes in the limnology of Twin Lakes resulting from the operation of the Mt. Elbert Pumped-Storage Powerplants. This report presents preoperation chlorophyll concentrations in the lakes from 1977-1981. Twin Lakes are oligotrophic, dimictic, and cool, high-mountain lakes that are thermally stratified between spring and fall turnover periods. They are ice-covered in winter and poor in P and N nutrients. The mean average chlorophyll a concentration in Twin Lakes was 3.2 mg/cu m. The minimum observed chlorophyll a concentration was < 0.1 mg/cu m, while the maximum was 52.1 mg/cu m. Twin Lakes tend to be more productive after fall turnover and continue to be productive into winter if snow cover is light. Midwinter peaks in chlorophyll concentration occurred in the upper lake in 1977, 1978, and 1981, and in the lower lake in 1981. Summer peaks in chlorophyll a concentration have occurred in both lakes, but have never been observed simultaneously. The upper lake experienced summer peaks in chlorophyll concentration in 1977 and 1981; the lower lake in 1979. Summer chlorophyll distribution peaks occur at or near the thermocline; in winter they are closer to the surface. The minimum chlorophyll concentrations in both lakes occurs just before spring and fall turnover. Chlorophyll a biomass and other primary-productivity parameters are more variable in the upper lake because it acts as a receiving basin for the western slope and Lake Creek. (Geiger-PTT)
W86-03234

LIMNOLOGICAL APPLICATIONS OF MULTISPECTRAL REMOTE SENSING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 7B.
W86-03277

ESTIMATING PHYTOPLANKTON BIOMASS AND PRODUCTIVITY,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
J. J. Janik, W. D. Taylor, and V. W. Lambou.
Miscellaneous Paper E-81-2, U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. June 1981, Final Report. 23 p, 1 tab, 38 ref. Interagency Agreement No WES-78-12.

Descriptors: *Biomass, *Algae, *Phytoplankton, *Chlorophyll, *Photosynthesis, *Trophic level, *Comparison studies, *Aquatic productivity, Carbon dioxide, Oxygen, Nitrogen, Reservoirs, Lakes.

Methods for estimating phytoplankton biomass and productivity are compared to aid reservoir managers in answering questions about the status of primary producers. Estimations of numerical abundance is limited as a microscopic method for meas-

uring biomass due to variations in cell size of different organisms and species. Measurements of standing crop by cell volume is widely accepted in quantitative surveys. Cell surface area computations are of value when estimating the assimilative area for nutrients. Plasma (cytoplasm) volume measurements are difficult to make in phytoplankton surveys. Dry weight estimates of biomass are fast but subject to sample preparation errors; most of these errors are avoided in ash-free dry weight estimates of biomass. Chlorophyll a analysis is the most popular method for estimating standing crop. C, N and P analysis are also used for obtaining approximate estimations of standing crop. Oxygen measurements provide estimates of net and gross primary productivity as well as respiration. The use of CO2 measurements for estimating primary productivity must be accompanied by adjustments for pH. There is uncertainty as to whether the radiocarbon method measures net or gross photosynthesis or a rate between the two. Chlorophyll measurements may also be used to calculate productivity, but they are not as widely used as the other methods. Algae-related conversion formulas used to calculate particular biological and chemical components from available data are listed along with limitations and qualifications for each conversion.
W86-03303

THEODORE ROOSEVELT LAKE: 1981 SEDIMENTATION SURVEY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2J.
W86-03331

STUDIES OF THE LIMNOLOGY, FISH POPULATIONS, AND FISHERY OF TURQUOISE LAKE, COLORADO: 1979-80,
Colorado Div. of Wildlife, Fort Collins.
T. P. Nesler.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-82-5, Bureau of Reclamation, Engineering and Research Center, Denver, CO., July 1981. 31 p, 5 fig, 17 tab, 5 app, 21 ref.

Descriptors: *Limnology, *Fish populations, *Lake fisheries. *Fish management, Fisheries, Reservoir fisheries, Reservoirs, Lake morphology, Ecosystems, Algae, Chlorophyll, Trout, Pumped storage, Phytoplankton, Salmon, Turquoise Lake, Colorado, Fish.

Turquoise Lake is one of the primary storage reservoirs in the Fryingpan-Arkansas Water Project and provides supplementary water by conduit to the Mt. Elbert Forebay-Twin Lakes system for pump-back storage power generation. The reservoir may be characterized as a dimictic, cold-water lake that is well oxygenated, relatively unbuffered, and slightly acidic. The lake may be classified as oligotrophic on the basis of total dissolved solids, algal nutrients (N-P), and chlorophyll concentrations. Depletion of dissolved oxygen occurs regularly in the hypolimnion during late summer and late winter. Turquoise Lake is limnologically similar to Twin Lakes (Colo.) in most respects, but Twin Lakes may be affected by the colder temperatures of the water imports from Turquoise Lake and from the introduction of Tabellaria and Daphnia. The Turquoise Lake fishery is based on the stocked, creel-sized rainbow trout (Salmo gaindneri Richardson), which made up 95% of the 1980 summer harvest. Catch rates have remained in the 0.59-0.70 fish/hour range between 1972-73 and 1980 despite similar levels of rainbow trout stocking and a 45 percent increase in fishermen effort to 62,000 man-hours (84 hours/hectare). Marked rainbow trout returned in the harvest at only a 28% return rate during one summer season but continued to contribute to the fishery in the following year. Fall stocking of rainbow trout and a good winter survival of these fish contributed significantly to high catch rates in the following spring and summer. Lake trout (Salvelinus namaycush Walbaum) have been unable to establish a self-sustaining population in the reservoir and recruitment past a 356 mm length or 5 years is negligible. The lake trout population must be maintained by periodic stocking. Turquoise Lake demonstrates potential as a kokanee salmon (Oncorhynchus nerka Suckley) fishery and spawn source.
W86-03339

DYNAMICS OF LOTIC SYSTEMS,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5C.
W86-03375

RESOURCE SPIRALING: AN OPERATIONAL PARADIGM FOR ANALYZING LOTIC ECOSYSTEMS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W86-03376

SERIAL DISCONTINUITY CONCEPT OF LOTIC ECOSYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 5C.
W86-03377

CONCEPTUAL FRAMEWORK FOR PROCESS STUDIES IN LOTIC ECOSYSTEMS,
Oregon State Univ., Corvallis. Dept. of Botany and Plant Physiology.
For primary bibliographic entry see Field 5C.
W86-03378

PREDICTABILITY OF STREAM ECOSYSTEM MODELS OF VARIOUS LEVELS OF RESOLUTION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. H. Wlosinski, and G. W. Minshall.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 69-86 p, 5 fig, 7 tab, 13 ref.

Descriptors: *Aquatic environment, *Model studies, Stream biota, Aquatic communities, Invertebrates, Nutrients, Fish, Dissolved solids, Detritus, Organic matter, Organic carbon, Functional groups.

One of the major decisions that must be made when developing ecosystem models concerns the level of resolution at which the ecosystem is to be simulated. The studies reported here were conducted to show the relationship between model resolution and predictability for the Aquatic Model developed by the Desert Biome, United States International Biological Program (US/IBP). To meet the objective of this study, data collected in a small desert stream (Deep Creek, Idaho-Utah) were used to create four data sets, each at a different level of resolution. Each data set included four plant groups, two detrital categories, decomposers, nutrients, fish, and macroinvertebrates. The invertebrates were sampled in a manner that allowed simulation of the ecosystem at four levels of resolution. Validation of the model consisted of comparing model predictions to the 95% confidence intervals of over 1000 measured values. Totals calculated for a number of state variables representing invertebrates at higher levels of resolution were compared with values predicted by models of lower resolution. Of 235 comparisons common to all four levels of resolution, 127, 142, 154, and 142 predicted values were within the 95% confidence intervals of empirical data for the finest through coarsest levels of resolution, respectively. Therefore, it was concluded that modeling the invertebrates at the functional level gave the best predictions of the Deep Creek ecosystem by the Desert Biome Aquatic Model. (Author)
W86-03379

EFFECT OF SIMULATED CANOPY COVER ON REGULATION OF NITRATE UPTAKE AND PRIMARY PRODUCTION BY NATURAL PERIPHYTON ASSEMBLAGES,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5B.
W86-03382

ENERGY BASIS OF ECOSYSTEM CONTROL AT SILVER SPRINGS, FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
R. L. Knight.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 161-179, 6 fig, 5 tab, 23 ref.

Descriptors: *Aquatic environment, *Lotic environment, *Energy regulation, *Metabolism, Stream biota, Microcosm studies, Primary productivity, Silver Springs, Florida, Cycling nutrients, Snails, Mosquito fish, Community metabolism, Ecosystems.

It has been suggested by some investigators that consumer populations (herbivores, primary carnivores, etc.) regulate system energy flow by such mechanisms as nutrient regeneration or cropping producers to optimal growth levels. A need exists, however, to examine such effects by experimentally regulating consumers over realistic density ranges. This paper presents an hypothesis predicting consumer effect on system functioning, along with evidence of consumer control of system metabolism at Silver Springs, Florida. The hypothesis predicts feedback of controlling action equal to energy invested in consumer components of ecosystems. This hypotheses was tested with field measurements of system productivity, after major alterations in fish populations were noted, and in replicable flow-through microcosms located in the river channel. Overall system metabolism of Silver Springs was found to be unchanged; this possibly indicates adaptation to loss of dominant consumers by replacement with functionally similar fish species. Optimal primary productivity in microcosms corresponded with snail densities ranging from 22 to 44 g/sq m, compared to 42 g/sq m in the natural river ecosystem. For mosquito fish, optimal primary productivity in microcosms corresponded to 3.2 g/sq m and 4 g/sq m in the river. (Author)
W86-03383

INFLUENCE OF HYDROLOGIC VARIATIONS ON PHOSPHORUS CYCLING AND RETENTION IN A SWAMP STREAM ECOSYSTEM,
North Carolina Univ. at Chapel Hill.
L. A. Yarbro.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 223-245, 5 fig, 3 tab, 49 ref. N-084-NC and B-110-NC.

Descriptors: *Aquatic environment, *Lotic environment, *Wetlands, Phosphorus, Cycling nutrients, Streams, Creeping swamp, North Carolina, Flood plains, Runoff, Hydrologic regime.

The fluxes and retention of filterable reactive phosphorous (FRP), filterable unreactive phosphorus (FUP), and particulate phosphorus (PP) in a floodplain swamp in eastern North Carolina varied in response to the seasonality of inundation and yearly variations in runoff from the upstream watershed. During the cool season flooded period, the floodplain forest floor had a high adsorption capacity for runoff-derived FRP that was both temperature and water FRP concentration dependent. The FUP, on the other hand, was released from the forest floor in approximate proportion to the volume of floodwaters. During the warm season, when decomposition rates were faster and standing water concentrations of phosphorus were relatively high, little or no runoff occurred; thus there was no significant loss of phosphorus from the ecosystem. Overall, 30 to 56% of total phosphorus inputs were retained by the swamp ecosystem during the 2 years of study. (Author)
W86-03386

NITRATE-NITROGEN MASS BALANCES FOR TWO ONTARIO RIVERS,
York Univ., Downsview (Ontario).
For primary bibliographic entry see Field 5B.
W86-03396

2I. Water In Plants

VEGETATION AND CLIMATES OF THE LAST 45,000 YEARS IN THE VICINITY OF THE NEVADA TEST SITE, SOUTH-CENTRAL NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
W. G. Spaulding.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-535, 1983. 199 p, 25 fig, 25 tab, 115 ref.

Descriptors: *Great Basin Desert, Middens, *Mojave, *Nevada, Test site, Packrats, *Paleoclimates, Paleoclimatology, Quaternary, *Vegetation, History, Semi-arid lands.

Paleoclimatic reconstructions for the Nevada Test Site, spanning the last 45,000 years, are based on plant macrofossil assemblages from radiocarbonated packrat (Neotoma spp) middens from south-central Nevada. The temperature regime during the Wisconsin glacial age, from before about 45,000 years ago until about 12,000 years ago, was characterized by lower temperatures during all seasons. Wisconsin maximum (about 18,000 years before present) winter temperatures were at least 6 deg. Celsius below those of the present, and the relative decrease in summer temperature was as much as 8 deg. Celsius. The data provide evidence for a precipitation regime drier than that proposed by many studies. The maximum estimated increase in average annual precipitation during the full-glacial period is 40 percent above current precipitation. The increase in temperature signaling the end of the Wisconsin glacial age may have begun as early as about 16,000 years ago. The oldest record of desert scrub vegetation from the Nevada Test Site area dates to about 15,000 years ago. By 10,000 years before present, average annual temperatures may have approximated present values, although seasonal temperature and precipitation regimes probably differed from those of today. Climate changes during the last 10,000 years have been relatively minor variations in a warm, dry climatic regime. Probably future climatic changes include a brief but pronounced warm period within the next 500 years, followed by a protracted transition to the next glacial age during the next 10,000 years. (USGS)
W86-03168

EFFECTS OF DECREASED WATERING ON WHEAT AND BARLEY YIELDS,
New Mexico Water Resources Research Inst., Las Cruces.
For primary bibliographic entry see Field 3F.
W86-03289

PRIMARY PRODUCTION AND DECOMPOSITION OF SUBMERGENT AND EMERGENT AQUATIC PLANTS OF TWO APPALACHIAN RIVERS,
North Texas State Univ., Denton. Inst. of Applied Sciences.
For primary bibliographic entry see Field 5C.
W86-03389

2J. Erosion and Sedimentation

STREAMFLOW AND WATER QUALITY OF ONION RIVER, WISCONSIN--AN ASSESSMENT OF NONPOINT-SOURCE DISCHARGES,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02932

PHYSICAL BASIS AND POTENTIAL ESTIMATION TECHNIQUES FOR SOIL EROSION PARAMETERS IN THE PRECIPITATION RUNOFF MODELING SYSTEM (PRMS),
Geological Survey, Nashville, TN. Water Resources Div.
W. P. Carey, and A. Simon.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4218, 1984. 32 p, 8 fig, 2 tab, 69 ref.

Descriptors: *Soil erosion, *Watershed models, Physical properties, *Simulation analysis, Hydraulic detachment(Soil), *Model studies.

Simulation of upland-soil erosion by the Precipitation-Runoff Modeling System currently requires the user to estimate two rainfall detachment parameters and three hydraulic detachmment paramenters. One rainfall detachment parameter can be estimated from rainfall simulator tests. A reformulation of the rainfall detachment equation allows the second parameter to be computed directly. The three hydraulic detachment parameters consist of one exponent and two coefficients. The initial value of the exponent is generally set equal to 1.5. The two coefficients are functions of the soil's resistance to erosion and one of the two also accounts for sediment delivery processes not simulated in the model. Initial estimates of these parameters can be derived from other modeling studies or from published empirical relations. (USGS)
W86-02943

SEDIMENT AND WATER-QUALITY FOR THE WEST BRANCH SHADE AND EAST BRANCH SHADE RIVER BASINS, OHIO, 1983 WATER YEAR,
Geological Survey, Columbus, OH. Water Resources Div.
C. J. O. Childress, and R. L. Jones.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-187, 1985. 16 p, 4 fig, 3 tab, 12 ref.

Descriptors: *Sedimentation, *Water quality, Hydrologic data collections, Cross-sections, Strip mines, Land reclamation, West Shade River Basin, *Ohio.

Sedimentation in and flooding of the West Branch Shade River and its tributaries have been major concerns of residents and State and local officials. The area was extensively surface-mined for coal between the mid-1940's and the early 1960's. Reclamation efforts immediately after mining were unsuccessful. The results have been elevated sediment loads and the subsequent loss of channel conveyance. Two sediment and stream-gaging stations were established on the West Branch Shade River and one station was established on the East Branch Shade River. The data will help to evaluate the effectiveness of current reclamation activities on reducing sediment loads. From June through September 1983, suspended-sediment yield was 18 times higher in West Branch (218 tons per square mile) than East Branch Shade River (12 tons per square mile). In addition, acidity is higher, pH is lower, and concentrations of dissolved sulfate and metals are higher in the West Branch Shade river basin than in the East Branch Shade river basin. (USGS)
W86-02947

COMPUTER PROGRAM FOR THE COMPUTATION OF TOTAL SEDIMENT DISCHARGE BY THE MODIFIED EINSTEIN PROCEDURE,
Geological Survey, Lakewood, CO. Water Resources Div.
H. H. Stevens.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4047, 1985. 14 p, 8 ref, 10 append.

Descriptors: *Computer programs, Data processing, Rivers, Sediment transport, *Sediment load, *Modified Einstein procedure, Total sediment discharge.

Two versions of a computer program to compute total sediment discharge by the modified Einstein procedure are presented. The FORTRAN 77 language version is for use on the PRIME computer, and the BASIC language version is for use on most microcomputers. The program contains built-in limitations and input-output options that closely follow the original modified Einstein procedure. Program documentation and listings of both versions of the program are included. (USGS)
W86-02964

CORRELATION OF PALEOSTRUCTURE AND SEDIMENT DEPOSITION IN THE MADISON LIMESTONE AND ASSOCIATED ROCKS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, WYOMING, AND NEBRASKA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02977

CHANGES IN CHANNEL GEOMORPHOLOGY OF SIX ERUPTION-AFFECTED TRIBUTARIES OF THE LEWIS RIVER, 1980-82, MOUNT ST. HELENS, WASHINGTON,
Geological Survey, Vancouver, WA. Water Resources Div.
H. Martinson, S. Finneran, and L. J. Topinka.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-1984. 113 p, 17 fig, 6 tab, 14 ref.

Descriptors: *Cross-sections, *Channel erosion, *Geomorphology, *Channel accretion, Volcanoes, *Mount St. Helens, *Washington, Lewis River, Pine Creek, Muddy Creek, Smith Creek, Swift Creek, Bean Creek, Clearwater Creek, Channel geometry, Channel aggradation.

The May 18, 1980, eruption of Mount St. Helens generated a lateral blast, lahars and tephra deposits that altered tributary channels in the Lewis River drainage basin. In order to assess potential flood hazards, study channel adjustments, and construct a sediment budget for the perturbed drainages on the east and southeast flanks of the volcano, channel cross sections were monumented and surveyed on Pine Creek, Muddy River, and Smith Creek during September and October of 1980. Additional cross sections were monumented and surveyed on Swift Creek, Bean Creek, and Clearwater Creek during the summer of 1981. The network of 88 channel cross sections has been resurveyed annually. Selected cross sections have been surveyed more frequently, following periods of higher flow. The repetitive cross-section surveys provide measurements of bank erosion or accretion and of channel erosion or aggradation. The report presents channel cross-section profiles constructed from the survey data collected during water years 1980-82. (USGS)
W86-02979

MEASURING THE SURFACE AREA OF SEDIMENT-PARTICLES,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03007

IMPACT OF AN OUTBURST OF SPIRIT LAKE ON THE COLUMBIA RIVER,
Geological Survey, Tacoma, WA. Water Resources Div.
W. G. Sikonia.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4054, 1985. 55 p, 40 fig, 3 tab, 13 ref.

Descriptors: *Floods, Flood crest, Flood hydrographs, *Sediment transport, Deposition, Computer models, Hydraulic models, *Mudflows, *Columbia River, *Mount St. Helens, Spirit Lake, *Washington.

A one-dimensional sediment-transport computer model was used to study the effects of an outburst of Spirit Lake on the Columbia River. According to the model, flood sediment discharge to the Columbia from the Cowlitz would form a blockage to a height of 44 feet above the current streambed of the Columbia River, corresponding to a new

streambed elevation of -3 feet, that would impound the waters of the Columbia River. For an average flow of 233,000 cubic feet in that river, water surface elevations would continue to increase for 16 days after the blockage had been formed. The river elevation at the Trojan nuclear power plant, 5 miles upstream of the Cowlitz River, would rise to 32 feet, compared to a critical elevation of 45 feet, above which the plant would be flooded. For comparison, the Columbia River at average flow without the blockage has an elevation at this location of 6 feet. Correspondingly high water surface elevations would occur along the river to Bonneville Dam, with that at Portland, Oregon, for example, rising also to 32 feet, compared to 10 feet without the blockage. (USGS)
W86-03008

SURVEY OF FENA RESERVOIR, ISLAND OF GUAM: LIMNOLOGICAL RECONNAISSANCE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2H.
W86-03018

HYDROLOGY AND SEDIMENT TRANSPORT MOANALUA VALLEY, OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
P. J. Shade.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-41 56. 1984. 54 p, 14 fig, 14 tab, 56 ref.

Descriptors: *Rainfall-runoff relationship, *Model studies, *Sediment transport, Calibration, Suspended sediment, Recharge, *Hawaii, Moanalua Valley, Oahu.

The rainfall-runoff relationship and sediment transport were analyzed for Moanalua Valley, Oahu, an undeveloped watershed in Hawaii. Rainfall, streamflow, and evaporation data were input to the Dawdy, Schaake, and Alley distributed routing rainfall-runoff model (DSA). The model was calibrated and verified for this rural tropical watershed indicating that on an event basis the average estimate of runoff is 35 percent of rainfall. A basin water balance computer using calibrated model parameter values, indicates an average of 7 million gallons per day groundwater recharge. Sediment transport was determined from daily and intermittent suspended-sediment samples collected at two sites, and from debris basin surveys. The estimated mean annual sediment yield ranges between 500 and 1,000 tons/mi2/yr. (USGS)
W86-03034

STREAMFLOW AND SUSPENDED-SEDIMENT DISCHARGE FROM TWO SMALL WATERSHEDS IN SOUTHWESTERN WYOMING AND NORTHEASTERN UTAH, 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03066

CALCULATING SEDIMENT DISCHARGE FROM A HIGHWAY CONSTRUCTION SITE IN CENTRAL PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03102

RECONNAISSANCE STUDY OF STREAM SEDIMENTAION, SOUTHERN GUAM,
Geological Survey, Honolulu, HI. Water Resources Div.
P. J. Shade.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4212, 1983. 33 p, 13 fig, 9 tab, 10 ref.

Descriptors: *Sediment yield, Basins, *Flow duration, *Sedimentation, *Suspended sediment, Reservoir, *Survey, *Guam, Talofofo, Ylig, Ugum, Fena.

This study uses limited available data to estimate sediment yields for three basins in southern Guam. The flow-duration sediment-rating curve method, reservoir survey data, and Pacific southwest Inter-Agency Committee (PSIAC) formula were used. Daily suspended-sediment samples were collected at USGS gaging stations on the Ylig and Ugum Rivers for one year. Intermittent samples were collected from the Talofofo River for six months. Although limited, these data are used in the flow-duration sediment-rating-curve method to estimate mean suspended-sediment yields. Fena Reservoir sedimentation data are used to test the applicability of the PSIAC formula in the three basins. Estimates of suspended-sediment yields are 467 to 845, 678 to 977, and 634 to 855 tons per year per square mile for the Talofofo, Ylig, and Ugum basins, respectively. PSIAC estimates of total sediment yield are 1,200 tons/yr/mi2 for the Talofofo, 1,385 tons/yr/mi2 for the Ylig, and 1,210 tons/yr/mi2 for the Ugum basins. These values are comparable to estimates of sediment yields from several similar basins on Oahu, Hawaii. It appears that the PSIAC method can be a useful tool in estimating sediment yields in some tropical areas. (USGS)
W86-03112

ESTIMATES OF LONG-TERM SUSPENDED-SEDIMENT LOADS IN BAY CREEK AT NEBO, PIKE COUNTY, ILLINOIS, 1940-80,
Geological Survey, Urbana, IL. Water Resources Div.
T. R. Lazaro, K. K. Fitzgerald, and L. R. Frost.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4003, 1984. 22 p, 9 fig, 5 tab, 7 ref.

Descriptors: *Suspended sediments, *Sediment load, *Sediment transport, *Illinois, Pike County, Bay Creek.

Five years of daily suspended-sediment discharges (1968, 1969, 1975, 1976, and 1980) for Bay Creek at Nebo, Illinois, computed from once- or twice-weekly samples (more often during storm events), were used to develop transport equations that can be used to estimate long-term suspended-sediment discharges from long-term water-discharge records. Discharge was divided into three groups based on changes in slope on a graph of logarithms of water discharge versus suspended-sediment discharge. Two subgroups were formed within each of the three groups by determining whether the flow was steady or increasing, or was decreasing. Seasonality was accounted for by introducing day of the year in sine and cosine functions. The suspended-sediment load estimated from the equations for the 5 years was 77.3 percent of that computed from daily sediment- and water-discharge records for those years. The mean annual suspended-sediment load for 41 years of estimated loads was 359,500 tons, which represents a yield of about 3.5 tons per acre from the Bay Creek drainage basin. (USGS)
W86-03138

RELATIONS OF SUSPENDED SEDIMENT TO STREAMFLOW IN THE GREEN RIVER, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
B. H. Ringen.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4026, 1984. 14 p, 4 fig, 3 tab, 6 ref.

Descriptors: *Sediment concentration, *Sediment discharge, *Regression analysis, Streamflow, Statistical methods, *Temporal-concentration graph, *Sediment-transport curve, *Wyoming, Green River basin, Correlation.

The relation of suspended-sediment concentration to water discharge was computed using regression analysis for 33 stations and 2 miscellaneous sites in the Green River basin, Wyoming. These relations show that suspended-sediment concentrations vary in direct proportion to streamflow. The number of coincident instantaneous suspended-sediment concentration and water-discharge values available for each regression analysis ranged from 6 to 98. Standard error of estimates for 35 relationships were usually large and correlation were relatively small. Large standard errors and small correlations are expected because of the complexity of the fluvial system. The effects of other factors, such as geology, topography, climate, soils, vegetation, and land use were not evaluated. Daily suspended-sediment discharges for four stations were computed by the 'sediment-transport-curve' method described in this report, and compared with values computed by the traditional 'temporal-concentration-graph' method. Annual sediment yields in tons per square mile drainage area, were compared in like manner. For those stations examined, values computed by the 'sediment-transport-curve' method were within 58 percent of those computed by the temporal-concentration-graph' method when only one year of record was used, but were within 12 to 21 percent when 2 to 4 years of record were averaged. (USGS)
W86-03174

MORPHOLOGICAL MODELLING FOR RIVERS WITH NON-UNIFORM SEDIMENT,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
J. S. Ribberink.
Internal Report No 1-80, 1982, 144 p, 32 fig, 12 tab, 23 ref, 1 append.

Descriptors: *Channel morphology, *Mathematical models, *Sediment transport, *Mathematical equations, *Rivers, Models, Model studies, Prediction, Mathematical studies, Fluvial sediments, Flow velocity.

The mathematical prediction of morphological changes in rivers due to natural causes or human interference has received much attention during the last two decades. The existing mathematical model for morphological computations in rivers consists of two water-equations and two sediment-equations. In principle these equations are a continuity equation and an equation of motion for both phases. This study attempts to reduce the complexity of the analysis by assuming the presence of nearly uniform sediment. A quasi-steady flow, constant bed roughness and local transport as a function of local conditions are also assumed. The derivation of the equations needed for the new model is presented. To gain insight into the workings of the new model, a restriction of only two sediment fractions is used. Specific calculations are carried out of the characteristic directions and relations. The influence of two possible concepts for a transport formula per fraction is studied. Four simple applications of the mathematical model for two sediment fractions are created. The water motion is simplified to enable manual calculations. The equation of motion of the sediment is a sediment transport formula which implies a direct relationship between sediment transport and the depth-averaged water velocity. (Geiger-PTT)
W86-03269

DETERMINATION OF TURBIDITY PATTERNS IN LAKE CHICOT FROM LANDSAT MSS IMAGERY,
Kentron International, Inc., Hampton, VA. Technical Center.
S. R. LeCroy.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-32788, Price codes: A03 in paper copy, A01 in microfiche. Report No. CP-32-04237, January 1982. 42 p, 23 fig, 18 ref.

Descriptors: *Sedimentation, *Satellite technology, *Remote sensing, *Turbidity, *Lakes, *Sediment transport, *Spectroscopy, *Turbidity flow, Lake sediments, Erosion, Infrared imagery, Aerial photography, *Arkansas, Lake Chicot.

A historical analysis of all applicable Landsat imagery was conducted on the turbidity patterns of

Lake Chicot, located in the Southeastern corner of Arkansas. By examining the seasonal and regional turbidity patterns, a record of sediment dynamics and possible disposition can be obtained. Sketches were generated from the suitable imagery, displaying different intensities of brightness observed in bands 5 and 7 of Landsat's multispectral scanner data. Differences in and between band 5 and 7 indicate variances in the levels of surface sediment concentrations. High sediment loads are revealed when distinct patterns appear in the band 7 imagery. Additionally, the upwelled signal is exponential in nature and saturates in band 5 at low wavelengths for large concentrations of suspended solids. (Author)
W86-03291

ENGINEERING GEOLOGY AND GEOMORPHOLOGY OF STREAMBANK EROSION: REPORT 4, SUPPLEMENTAL UPDATE TO REPORT 3: THE APPLICATION OF WATERBORNE GEOPHYSICAL TECHNIQUES IN FLUVIAL ENVIRONMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.
J. R. May.
Technical Report GL-79-7, September 1982. 11 p, 3 ref.

Descriptors: *Bank erosion, *Sediment erosion, *Soil erosion, *Stream degradation, Errors, *Wave action, Flood waves, Rivers, Erosion, Wind erosion, Ohio River, Navigable rivers.

This supplementary report addresses portions of Report 3 in the series 'Engineering Geology and Geomorphology of Streambank Erosion' to restate certain paragraphs that contain significant errors. In addition, this supplement provides a data-based explanation of causation of streambank failure and erosion observed at the Ohio Rivery survey sites. Supplemental data resulting from studies conducted by the U.S. Army Corp of Engineers along the Ohio River show that wind-generated wave action has a negligible effect on Ohio River banks due to low wave heights and short fetch lengths. Principal sites where traffic-generated waves and turbulence may result in bank erosion are limited to areas of the bank line located at locking and docking facilities and fleeting and staging areas. Bank failures most often occur within short time periods in response to storms and floods. Bank erosion has been historically persistent along the entire length of the Ohio River but evidence indicates that this erosion has not been caused by the construction or operation of the navigation structures. Soil composing the banks has been eroded (rather than stripped) and carried into the river.
W86-03320

THEODORE ROOSEVELT LAKE: 1981 SEDIMENTATION SURVEY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. M. Lara.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-82-18, September 1982. 89 p, 66 fig, 3 tab.

Descriptors: *Reservoir capacity, *Surveys, Capacity, *Reservoir silting, *Reservoir storage, *Lake sediments, *Sounding, *Sonar, Reservoirs, Sediments, Silting, Water storage, Storage, Lakes, Hydrographs, Water depth, Arizona, Theodore Roosevelt Lake.

Theodore Roosevelt Lake was surveyed in 1981 to compile field data needed to compute the reservoir capacity. The data were also used to compute the volume of sediments that had accumulated in the reservoir since the gates of the dam were closed in 1909. Twenty-eight sediment samples from reservoir deposits were collected from various reservoir ranges throughout the lake. Sonic depth recording equipment interfaced with an automated survey system was used to run the hydrographic survey. Reservoir capacity was computed based on surface areas determined by a width-ratio method. The capacity of the reservoir is now 1.65 x 10 to the 9th power cu m (1,336,734 acre-ft), and the reservoir has a surface area of 7016 hectares (17,337 acres). Since 1909, 2.39 x 10 to the 8th power cu m (193,765 acre-ft) of sediment accumulation have resulted in about a 13 percent loss of capacity. (Author)
W86-03331

2K. Chemical Processes

EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING MAJOR DISSOLVED-ION YIELDS OF STREAMS IN THE UNITED STATES,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02923

WATER QUALITY OF A STREAM-AQUIFER SYSTEM, SOUTHERN FRANKLIN COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
J. T. de Roche, and A. C. Razem.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4238, 1984. 44 p, 8 fig, 7 tab, 20 ref.

Descriptors: *Glacial aquifers, *Induced infiltration, *Geochemistry, Geohydrology, Chemical composition, Mass transfer, *Surface-groundwater relationships, *Ohio, Franklin County.

The water resources in the Scioto River valley south of Columbus, Ohio were evaluated as a potential water supply, based on data collected from 74 wells and 4 surface-water sites. A very hard calcium bicarbonate water high in dissolved solids is characteristics of the area. Mean pH of the ground water is 7.3 and concentrations of bicarbonate range from 238 to 530 milligrams per liter (mg/L). Concentrations of dissolved iron in water samples (0.01 to 3.9 mg/L) frequently exceed the Ohio Environmental Protection Agency's recommended limit of 0.3 mg/L. The chemical quality of local streams closely parallels the ground-water quality, except for higher levels of sodium, chloride, and sulfate in the surface water. Microbiological testing of ground water from several wells indicated high concentrations of fecal coliform and fecal streptococci bacteria. The contamination was probably due to infiltration of surface waters through improperly sealed wells during a recent flood. Mass-balance calculations on the chemical data indicate that pH is buffered primarily by the carbonate system, and that areas of different chemical environments exist within the aquifer. (USGS)
W86-02931

SEDIMENT AND WATER-QUALITY FOR THE WEST BRANCH SHADE AND EAST BRANCH SHADE RIVER BASINS, OHIO, 1983 WATER YEAR,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02947

SELECTED TRACE-ELEMENT DATA FOR STREAMS IN THE SOUTHERN YAMPA RIVER BASIN, NORTHWESTERN, CO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02967

QUANTITATIVE ANALYSIS OF THE HYDROTHERMAL SYSTEM IN LASSEN VOLCANIC NATIONAL PARK AND LASSEN KGRA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02994

INDEX OF GROUND-WATER QUALITY DATA FOR FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03002

RESULTS OF THE U.S. GEOLOGICAL SURVEY'S SECOND INTERNATIONAL INTERLABORATORY ANALYTICAL COMPARISON STUDY--STANDARD-REFERENCE WATER SAMPLES M-86 (MAJOR CONSTITUENTS), T-87 (TRACE CONSTITUENTS), AND P-5 (PRECIPITATION SNOWMELT),
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03013

GROUND-WATER-QUALITY DATA FROM THE SOUTHERN POWDER RIVER BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. R. Larson, and R. L. Daddow.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-939, 1984. 56 p, 2 fig, 3 tab, 3 ref.

Descriptors: Wqter quality, *Chemical analysis, *Trace elements, *Radiochemical analysis, Wells, Springs, Aquifers, *Coal mine effects, *Southern Powder River basin, *Wyoming, Northern Great Plains RASA, *Coal hydrology.

Water-quality data for wells and springs in the Powder River basin in northeastern Wyoming are presented in three tables. The first table lists results of analyses of common constituents for 748 ground-water sites. The second table presents dissolved-trace-metal data for 220 ground-water sites. Radiochemical data are listed in the third table for 65 ground-water sites. The locations of the sites listed in the tables are shown on a map of the area. (USGS)
W86-03014

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON, COS., TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03045

WATER-RESOURCES MONITORING IN THE COTTONWOOD CREEK AREA, SHASTA AND TEHAMA COUNTIES, CALIFORNIA, 1982-83,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03054

DATA FROM A SOLUTE TRANSPORT EXPERIMENT IN THE LEVIATHAN MINE DRAINAGE, ALPINE COUNTY, CALIFORNIA, OCTOBER 1982,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03055

FIELD GUIDELINES FOR COLLECTION, TREATMENT, AND ANALYSIS OF WATER SAMPLES, MONTANA DISTRICT,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03060

FILTRATION AND COLUMN-ADSORPTION SYSTEM FOR ONSITE CONCENTRATION AND FRACTIONATION OF ORGANIC SUBSTANCES FROM LARGE VOLUMES OF WATER,

Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03065

PREPARATION OF POLYETHLENE SACKS FOR COLLECTION OF SAMPLES FOR CHEMICAL ANALYSIS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03072

SURFACE-WATER QUANTITY AND QUALITY IN THE LOWER KENAI PENINSULA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03076

APPARENT WATER RESISTIVITY, POROSITY, AND WATER TEMPERATURE OF THE MADISON LIMESTONE AND UNDERLYING ROCKS IN PARTS OF MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03081

SELECTED HYDROLOGIC DATA FOR THE POWELL RIVER BASIN IN WISE COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03103

SELENIUM CONCENTRATIONS IN WATERS TRIBUTARY TO AND IN THE VICINITY OF THE KESTERSON NATIONAL WILDLIFE REFUGE, FRESNO AND MERCED COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03124

ATMOSPHERIC DEPOSITION OF SELECTED CHEMICALS AND THEIR EFFECT ON NONPOINT-SOURCE POLLUTION IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03125

TEMPORAL TRENDS IN THE ACIDITY OF PRECIPITATION AND SURFACE WATERS IN NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03135

EVALUATION OF GROUND-WATER QUALITY DATA FROM KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
C. L. Sprinkle, R. W. Davis, and D. S. Mull.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4240, 1983. 65 p, 33 fig, 4 tab, 34 ref.

Descriptors: *Water quality, *Groundwater, *Statistical analysis, Geochemistry, Groundwater pollution, Saline water, *Kentucky.

The report reviews and summarizes 10,578 chemical analyses, from 2,362 wells and springs in Kentucky. These water-quality data were collected prior to September 30, 1981, and are available in computer files of the U.S. Geological Survey. The principal water-bearing rocks in Kentucky were combined into 10 major groups to aid in data summary preparation and general description of the ground-water quality of the State. Ground water in Kentucky is generally fresh near the outcrop of the rocks comprising the aquifer. Slightly saline to briny water occurs at variable depths beneath the freshwater. Preparation of quadrilinear diagrams revealed three principal geochemical processes in the aquifers of Kentucky: (1) mixing of freshwater and saline water in an interface zone; (2) dedolomitization of the Devonian and Silurian and Lower Mississippian carbonate rocks; (3) sodium for calcium exchange in the freshwater sections of many of the sandstone-shale aquifers. A number of errors and deficiencies were found in the data base. The principal deficiencies were: (1) very few complete analyses which included important field measurements; (2) inadequate definition of the chemistry of the freshwater-saline water interface zone throughout much of the State; (3) no analyses of stable isotopes and dissolved gases; (4) fewer than 10 analyses of most trace metals, radionuclides, and man-made organic chemicals; and (5) no data on bacteria in ground water from any aquifer in the State. (USGS)
W86-03142

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN NORTHEASTERN MISSISSIPPI, AUGUST 1983,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-62, 1984. 21p, 5 fig, 3 tab, 7 ref.

Descriptors: *Water quality, Lignite, *Sediment load, *Cross-sections, *Low flow, *Mississippi, Calhoun County, Webster County, Montgomery County.

Hydrologic data were collected at 15 stream sites draining potential lignite areas in Calhoun, Montgomery, and Webster Counties during a period of low streamflow. The total dissolved solids ranged from 25 to 14.9 mg/L and most major ion concentrations were less and suspended sediment concentrations were less than 30 mg/L. The pH ranged from 6.7 to 8.1 units. Aluminum concentrations ranged from less than 100 to 500 micrograms per liter. Chromium and zinc concentrations ranged from 1 to 10 micrograms per gram and mercury concentrations ranged from 0.01 to 0.04 micrograms per gram in bottom material. (USGS)
W86-03162

CHEMICAL AND BIOLOGICAL QUALITY OF STREAMS AT THE INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1978-80,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03163

RECONNAISSANCE OF BENTHIC INVERTEBRATES FROM TRIBUTARY STREAMS OF THE YAMPA AND NORTH PLATTE RIVER BASINS, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03167

DATA FROM PUMPING AND INJECTION TESTS AND CHEMICAL SAMPLING IN THE GEOTHERMAL AQUIFER AT KLAMATH FALLS, OREGON,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03169

GEOHYDROLOGY OF THE NORTHERN PART OF THE TOWN OF BROOKHAVEN, SUFFOLK COUNTY, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03173

UNDERGROUND RESIDENCE TIMES AND CHEMICAL QUALITY OF BASAL GROUNDWATER IN PEARL HARBOR AND HONOLULU AQUIFERS, O'AHU, HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2F.
W86-03290

HYDROGEN AND OXYGEN ISOTOPE GEOCHEMISTRY OF COLD AND WARM SPRINGS FROM THE TUSCARORA, NEVADA THERMAL AREA,
Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
J. R. Bowman, and D. Cole.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-019920, Price codes: A02 in paper copy, A01 in microfiche. DOE/ID/12079-70, June, 1982. 14 p. 6 fig, 1 tab, 16 ref.

Descriptors: *Cold springs, *Hot springs, *Deuterium, *Oxygen isotopes, *Water chemistry, Water recharge, Bicarbonates, Temperature, Geochemistry, Topography, Evaporation, *Thermal Springs, *Nevada.

Eighteen cold and warm spring water samples from the Tuscarora, Nevada thermal area were analyzed for hydrogen and oxygen isotope composition and fluid chemistry. Warm springs have delta D values (-128 to -137 permil) significantly lower than those of cold springs to the north and east of the area, but similar to the delta D values of cold springs to the west and south (-131 to -135 permil). The recharge area for the warm springs is unlikely to be to the immediate north, which is the local topographic highland in the area. The hydrogen isotope data would permit recharge from areas to the southwest or from high elevations to the southeast (Independence Mountains), a sector consistent with electrical resistivity evidence of fluid flow. Warm springs are HC03(-)-rich waters, enriched by a factor of 3 to 10 in Na, HC03(-) and Si02 relative to local cold springs. Average quartz (no steam loss) and Na/K/Ca geothermometer estimates suggest subsurface temperatures of 145 C and 196 C, respectivley. The warm springs exhibit poor correlations between either hydrogen or oxygen isotope composition and water temperature or chemistry. The absence of such correlations suggests that there is no single coherent pattern of cold water mixing or evaporation in the thermal spring system.
W86-03308

INFLUENCE OF HUMIC-ACID COMPLEXING ON THE MOBILITY OF AMERICIUM IN THE SOIL AQUATIC ENVIRONMENT,
Washington State Univ., Pullman. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W86-03315

CHARACTERIZATION OF GLENWOOD SPRINGS AND DOTSERO SPRINGS WATERS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. J. Eisenhauer.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-83-10, October 1983. 52p, 10 fig, 14 tab.

Descriptors: *Salinity, *Colorado River, *Colorado, *Mineral springs, *Saline water, *Chemical properties, Springs, Physical properties, *Fate of pollutant, *Pollutant identification, *Trace elements, Path of pollutants, Water analysis, Water temperature, Aquifers, Hydrogen ion concentra-

tion, Cations, Anions, Radioactivity, Trace metals, Glenwood Springs.

The Bureau of Reclamation is endeavoring to find disposal methods for preventing high salinity water from 16 identified sources from entering the Colorado River. The Glen Dot (Glenwood Springs-Dotsero Springs) is one source that contributes 10% of the identified salt load or 227,000 metric tons annually. Data on the physical and chemical properties of the Glen-Dot waters were collected from 1972 to 1982 to aid in determining disposal methods and characterizing the aquifers for major constituents, trace metals, trace anions, radioactivity, and organic compounds. The Dotsero Springs, located in the Leadville limestone strata, had a combined flow rate for 11 identified springs of 0.220 cu m/sec. Temperatures of these waters ranged from 23 to 32 degrees. The pH ranged from 7.2 to 7.7 and total dissolved solids were 9.954 mg/L. The content of Na, Mg, Ca, K, Cl, sulfate and bicarbonate was 82, 10, 7, 1, 84.5, 8.7 and 6.8%, respectively. The Glenwood Springs, located in the Leadville limestone strata, had a combined flow rate for 14 identified springs of 0.296 cu m/sec. Temperatures of these waters ranged from 25 to 51 degrees. The pH ranged from 6.6 to 7.6 and total dissolved solids were 18,780 mg/L. The content of Na, Ca, K, Mg, Cl, sulfate and bicarbonate was 90, 7, 2, 1, 83.9, 10.2 and 6.0%, respectively. Lime treatment was recommended to reduce the Ca levels of the Glen-Dot waters.
W86-03333

WATER ANALYSIS, VOLUME III: ORGANIC SPECIES,
For primary bibliographic entry see Field 5A.
W86-03406

2L. Estuaries

DATA ON DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER AND TRANSITION ZONE OF THE POTOMAC ESTUARY, 1983 AND 1984,
Geological Survey, Reston, VA. Water Resources Div.
V. Carter, N. B. Rybicki, R. T. Anderson, T. J. Trombley, and G. L. Zynjuk.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-82, 1985. 61 p, 28 fig, 24 tab, 13 ref.

Descriptors: *Submersed aquatic vegetation, Vegetation maps, Aquatic weeds, Estuaries, *Tidal Potomac River, *Potomac River Estuary, *Maryland, *Virginia.

Data on the distribution and abundance of submerged aquatic vegetation were collected in the tidal Potomac River and transition zone of the Potomac Estuary during 1983 and 1984. Plant species were identifed on transects. Water-quality characteristics measured include temperature, specific conductance, and Secchi depth. Maps were made of the distribution of individual species based on transect samples and a complete shoreline survey. (USGS)
W86-02944

WATER SURFACE ELEVATIONS FOR THE HIGH TIDE OF DECEMBER 15, 1977, IN THE PUGET SOUND REGION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
L. M. Nelson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4293, 1985. 15 p, 8 fig, 1 tab, 5 ref.

Descriptors: *Water surface profiles, *Tidal effects, Tidal floods, Tides, *Puget Sound, *Washington, High-tide elevations.

An unusually high oceanic tide on December 15, 1977, caused flooding of lowlying, nearshore parts of western Washington, including several areas in the Puget Sound region. At Seattle, the December 15 high tide of 14.8 feet above MLLW (mean lower low water datum; 8.55 feet above the National Geodetic Vertical Daltum of 1929, or NGVD) was 0.1 foot higher than the 100-year high tide. At Neah Bay, near the western end of the Straits of Juan de Fuca, however, the high tide of 8.77 feet MLLW (4.55 feet NGVD) on that date was 3.2 feet lower than the 100-year high tide. This study has identified the observed December 15 high-tide elevations at many locations in the Puget Sound region. The observed high tide then was much higher than predicted in most of the Puget Sound region, primarily as the result of a very low barametric pressure. Little damage from wind waves was reported. Elevation profiles for the predicted and observed high tides on December 15 and for several other selected tide levels indicate an increase in the maximum height in the inland direction, except near Port Angeles, and show abrupt changes in tidal elevations at three constrictions - Admiralty Inlet, Tacoma Narrows, and Deception Pass. (USGS)
W86-02953

WATER-QUALITY STUDY OF THE TIDAL POTOMAC RIVER AND ESTUARY - AN OVERVIEW,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02975

WATER QUALITY OF THE TIDAL POTOMAC RIVER AND ESTUARY HYDROLOGIC DATA REPORTS SUPPLEMENT 1979 THROUGH 1981 WATER YEARS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-02997

PRIMARY PRODUCTIVITY IN THE POTOMAC TIDAL RIVER, MARYLAND, MAY 1980 TO AUGUST 1981,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03000

EFFECT OF EUSTATIC SEA-LEVEL CHANGES ON SALTWATER-FRESHWATER RELATIONS IN THE NORTHERN ATLANTIC COASTAL PLAIN,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03010

DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER AND ESTUARY, MARYLAND AND VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
V. Carter, J. E. Paschal, and N. Bartow.
Available from Dist Branch, USGS 604 S. Pickett St. Alexandria, VA 22034. USGS Water-Supply Paper 2234-A, 1985. 46 p, 20 fig, 20 tab, 86 ref.

Descriptors: Aquatic Plants, Nutrients, Plant growth, *Submersed aquatic plants, Aquatic habitats, Substrate, Estuaries, *Potomac River Estuary, Tidal Potomac River, *Maryland, *Virginia, District of Columbia.

The distribution and abundance of submersed aquatic vegetation in the tidal Potomac River and Estuary were studied from 1978 through 1982. Sixteen species of submersed aquatic plants were identified--fourteen vascular plants and two species of the algae Chara. Most of the plants were located in the transition zone of the Potomac River and Wicomico River tributary, with a few isolated populations in the tidal river and estuary. Vallisneria americana, Zannichellia palustris, Ruppia maritima and Potamogeton perfoliatus were the most abundant and widespread species. The present distribution differs considerably from that in the early 1900's when flats in the tidal river were covered with lush vegetation such as Vallisneria and Potamogeton spp., and the estuary had an abundance of Zostera marina. The factors responsible for the decline of submersed aquatic vegetation in the tidal Potomac River and Estuary are varied and may include storm damage in the 1930's; increasing nutrient enrichment with a shift in the relationship between submersed aquatic plants and phytoplankton, a change in light availability; and grazing by turtles, fish, muskrat, or waterfowl. Salinity dynamics may account for the presence of abundant vegetation and the diversity of species in the transition zone. (USGS)
W86-03012

SEASONAL PATTERNS OF ALKALINITY IN THE SAN FRANCISCO BAY, CALIFORNIA, ESTUARINE SYSTEM DURING 1980,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03059

SALINITY, ALKALINITY, AND DISSOLVED AND PARTICULATE ORGANIC CARBON IN THE SACRAMENTO RIVER WATER AT RIO VISTA, CALIFORNIA, AND AT OTHER LOCATIONS IN THE SACRAMENTO-SAN JOAQUIN DELTA, 1980,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03063

FRESHWATER RUNOFF AND SALINITY DISTRIBUTION IN THE LOXAHATCHEE RIVER ESTUARY, SOUTHEASTERN FLORIDA, 1980-82,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. M. Russell, and B. F. McPherson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4244, 1984. 36 p, 21 fig, 4 tab, 15 ref.

Descriptors: *Salinity, Rivers, Canals, *Estuaries, Water release, *Runoff, Loxahatchee River estuary, Canal 18, Jupiter Inlet, *Florida.

Freshwater mixed with seawater over a distance of 5 to 10 river miles in the Loxahatchee River estuary during a recent study. Large freshwater inflows vertically stratified the estuary and shifted the mixing zone seaward. In the northwest fork of the estuary, the saltwater-freshwater interface moved daily about 0.5 to 1.5 river miles as a result of tides, and annually about 3 to 5 miles as a result of seasonal changes in freshwater inflow. In the southwest fork, saltwater movement upstream was blocked by a gate and dam structure in Canal-18, 4.7 miles upstream from the Atlantic Ocean. Although Canal-18 discharged about one-third of the total freshwater tributary inflow to the estuary, the effects of canal discharge on salinity were limited to relatively brief periods. Much of the time, no freshwater was discharged. (USGS)
W86-03118

THEORETICAL AND OBSERVED PROFILES OF TIDAL CURRENTS AT TWO SITES ON THE SOUTHEASTERN BERING SEA SHELF,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
H. O. Mofjeld, J. D. Schumacher, and D. J. Pashinski.
NOAA Technical Memorandum ERL PMEL-62, October 1984. 60 p, 10 fig, 11 tab, 26 ref.

Descriptors: *Theoretical analysis, *Tidal currents, *Tidal hydraulics, *Hydraulic models, *Continental shelf, Models, Model studies, Tides, Eddies, Waves, Wave propagation, Wave action, Hydraulic similitude.

A semi-analytic theory for vertical profiles of tidal currents on the continental shelf is presented in which the vertical eddy viscosity is obtained with a high-resolution, Level II turbulence closure model. Each tidal constituent is assumed to be free shallow water wave propagating on an unstratified shelf on constant depth. The eddy viscosity is a time-dependent composite of contributions from the major tidal constituents. The theoretical profiles were fit to M2 and K1 current harmonic constants observed at two sites on the Southeastern Bering Sea Shelf. The fit of M2 and K1 theoretical profiles reproduced the general features of the tidal currents (rectilinear with Kelvin wave regime) at the coastal station BBL1 off the Alaska Peninsula. At the mid-shelf currents, the fit to the thin boundary layers observed for M2 and K1 revealed a small apparent bottom roughness (0.001 cm), possibly due to calm weather and/or the lack of bedforms. The theory overestimates slightly the width of the M2 ellipses but predicts the K1 width and perpendicular orientation of the M2 and K1 ellipses. The model provides estimates of residual tidal currents under very restrictive assumptions. For the coastal Kelvin waves, the residual tidal current is due almost entirely to Stokes drift, while for the Sverdrup waves, the magnitudes of the theoretical residual currents are a factor of 1/20 smaller than the coastal currents. (Geiger-PTT)
W86-03237

DATA FROM THE SALSX CRUISES: MAY 1978-JULY 1980,
Delaware Univ., Newark. Sea Grant Coll. Program.
C. H. Culberson, J. H. Sharp, T. M. Church, and B. W. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117085, Price codes: A04 in paper copy, A01 in microfiche. University of Delaware Oceanographic Data Report Number 2. February 1982. 53 p, 7 fig, 7 tab.

Descriptors: *Data acquisition, *Estuaries, Salinity, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Alkalinity, Phosphates, Nitrates, Nitrites, Delaware River, Trace metals, Organic carbon, Phosphorus, Ammonium.

Chemical and physical data collected during six cruises in the Delaware River and Bay from May 1978 to July 1980 are reported. These cruises, designated Salsx, covered the entire salinity gradient in the estuary from freshwater in the river near Philadephia to seawater at the entrance of the bay. During Salsx-2 and Salsx-4, stations were also occupied in the coastal waters off Delaware and New Jersey. In addition during Salsx-4 and Salsx-6, sampling in the freshwater portion of the estuary was extended from Philadelphia to Trenton, the head of the estuary. The following parameters were measured on board during the cruise: temperature, salinity, oxygen and pH. Total alkalinity, phosphate, nitrate, nitrite, ammonium, dissolved organic carbon and phosphorus, and particulate organic carbon were analyzed ashore for all cruises. Station positions were charted for all cruises. Trace metals were determined ashore for selected positions in cruises 2-6.
W86-03298

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

USE OF NON-CONVENTIONAL WATER RESOURCE IN DEVELOPING COUNTRIES,
United Nations, New York. Dept. of Technical Co-operation for Development.
Natural Resource/Water Series No. 14, ST/ESA/149, 1985. 278 p, 9 fig, 26 tab, 208 ref, 2 append.

Descriptors: *Desalination, *Water reuse, *Developing countries, *Icebergs, *Water supply development, *Water transport, Water resources development, Wastewater renovation, Reverse osmosis, Membrane processes, Distillation, Electrodialysis, Rural areas, Cost analysis, Weather modification, Evaporation control.

Twenty years after the United Nations issued a series of publications on water desalination prospects in developing countries, the use of non-conventional water resources in developing countries was reviewed. The progress made over the past 20 years in the use of desalination, transport of water, water reuse and enhancement of existing supplies or sources is reported. The development of brackish and sea-water sources through distillation methods, electrodialysis, and reverse osmosis is considered. Supply and demand evaluations, energy considerations, and factors related to process selection are economic aspects of desalination that are examined. Small-scale desalination units in rural areas, and the combination of desalination efforts with renewable energy sources are also discussed. The transport of water by tankers or in the form of icebergs is examined in relation to recent technological advances and applications in developing countries. Wastewater reuse is considered as a form of non-conventional water reuse. The enhancement of existing supplies or sources by weather modification and evaporation suppression is reviewed. Future prospects for all the methods examined in this publication are outlined. Annexes to the main text discuss the technical background of distillation, electrodialysis, and reverse osmosis. A list of United Nations publications on water resources development topics is given. (Geiger-PTT)
W86-03240

AUTOMATED PLUGGING FACTOR MONITOR: SPECIFICATIONS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. J. Eisenhauer, and S. C. Stitt.
Available from Engineering and Research Center, Denver, CO. Report No. REC-ERC-83-4, October 1983. 44 p, 6 fig, 1 app, 2 ref.

Descriptors: *Automation, Electronic equipment, *Monitoring, *Control systems, *Reverse osmosis, *Membrane processes, *Desalination, *Hydraulic equipment, Sampling, Membranes, Suspended soilds, Hydraulic machinery.

Efficient and economical control of a reverse osmosis membrane water desalting process is dependent on rapid but precise monitoring of the feed water parameter known as the plugging factor. The plugging factor measures the amount of microscopic organic and inorganic particulate matter within the size range measured which is suspended in the water. A totally automatic plugging factor monitor (PFM) test assembly was designed by and tested by government engineers. The PFM electronic controller drives the PFM tester to obtain the necessary data for calculating a plugging factor for a sample of water the PFM-SPSBP draws continuous flow samples of test water for 1-(6) reselected sources. The SPSBP flow operation is schematically diagramed. Other PFM-tester unit function and hardware specifications are also included along with engineer drawings of the mechanisms.
W86-03325

CATION EXCHANGE PRETREATMENT STUDIES FOR HIGH RECOVERY: YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. W. Kaakinen, and P. E. Laverty.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-82-11, October 1983. 295 p, 34 fig, 15 tab, 9 app, 33 ref.

Descriptors: *Desalination, *Desalination plants, *Cation echange, *Sulfates, *Water softening, *Gypsum, Pretreatment standards, Calcium sulfate, Ion exchange, Brines, Scaling, Resins, Demineralization, Adsorption, Yuma Desalting Plant.

The main purpose of the High Recovery Test Program was to obtain feasibility design data for cation exchange softening to allow a greater fractional recovery of desalted product water at the YDP (Yuma Desalting Plant). Compared to the original YDP design with 70% desalting recovery, additional removal of calcium in the sesalting feed would allow recoveries over 90%. The sole chemical regeneration solution for the IX (ion exchange) process during steady-state operation would be the sodium-rich brine from the desalting equipment. Pilot plant equipment to test this process was operated at the YDTF (Yuma Desalting Test Facility) and consisted of an IX unit and an electrodialyzer to supply reject-brine regenerant for the IX experiments. Because the reject-brine contained major concentrations of sulfate, gypsum scale occurred in the resin bed under certain IX operating conditions. Scaling occurred especially when the water temperatures were about 30 C in the summer. Scaling did not occur with water tempertures of 15 C in the winter. Gypsum scale buildup in the resin bed could be avoided by regeneration with a high upward flow rate causing a fluidized bed. Reuse of regenerant was also beneficial. Multiple regression analysis of the IX data delineated the importance of several control variables in the IX experiments, including regeneration concentration, flow rate, volume, and temperature. The major response variable was the specific calcium resin capacity divided by the IX cycle duration. This number is inversely proportional to the design resin requirement. Results show that the ion exchange high recovery pretreatment process is highly feasible, and that it is technically possible to achieve high recovery in the YDP. Numerous recommendations for a plant design are given and future studies are noted.
W86-03335

3B. Water Yield Improvement

USE OF NON-CONVENTIONAL WATER RESOURCE IN DEVELOPING COUNTRIES,
United Nations, New York. Dept. of Technical Co-operation for Development.
For primary bibliographic entry see Field 3A.
W86-03240

3C. Use Of Water Of Impaired Quality

MULTIPLE WATER REUSE IN POULTRY PROCESSING: CASE STUDY IN EGYPT,
Alexandria Univ. (Egypt). Higher Inst. of Public Health.
A. Hamza.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-156760, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/2-83-005, January 1983. 96 p, 21 fig, 30 tab, 22 ref. 3-542-2.

Descriptors: *Reclaimed water, *Water reuse, Water treatment, Chlorination, Water use, Impaired water use, Wastewater, Wastewater management, Wastewater treatment, Wastewater renovation, Food processing industry.

An industrial-scale multiple water reuse system was under investigation for a period of four years at a modern poultry processing plant in Alexandria, Egypt. The system involved: chlorination of cooling water from the compressor; reuse of this water in the chiller; successive transfer of an equivalent amount of water from the chiller to the prechiller, from the prechiller to the wash tank, and finally, from the wash tank to the scalder. Process waters in the prechiller and wash tank were alternately purified by diatomaceous earth filtration. Long-term studies at the plant indicated successful utilization of a multiple reuse system with chlorinated water (20 mg/l input) and a water makeup rate of 20 cu m/day. Build-up of contaminants (total aerobic and coliform counts) and pollutants (Grease, suspended residue, BOD and COD) in the immersion tanks were compared to normal operation. (Author)
W86-03274

3D. Conservation In Domestic and Municipal Use

EVALUATION OF THE ADSORPTION PROPERTIES OF SILICALITE FOR POTENTIAL APPLICATION TO ISOLATING POLAR LOW-MOLECULAR-WEIGHT ORGANICS FROM DRINKING WATER,
Ames Lab., IA.
For primary bibliographic entry see Field 5F.
W86-03266

3F. Conservation In Agriculture

ENERGY AND U.S. AGRICULTURE: IRRIGATION PUMPING, 1974-1980,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
G. Sloggett.
Agricultural Economic Report No. 495, December 1982. 36 p, 1 fig, 9 tab, 18 ref, 3 append.

Descriptors: *Irrigation, *Economic aspects, *Groundwater, Irrigation efficiency, Irrigation engineering, Water potentials, Irrigation practices, Irrigation wells, Pump wells.

Data on a variety of aspects of pump-irrigation fuel costs are presented. Pump irrigators can reduce energy costs by irrigating more efficiently. U.S. farmers increased onfarm pump irrigation by 21 percent from 1974 to 1980, adding 7.5 million pump-irrigated acres. Farmers irrigated 42.6 million acres in 1980 with onfarm pumps, and pump energy accounted for 23 percent of total energy used onfarm for crop production. Most irrigation pumps used electricity, followed in descending order by natural gas, diesel, liquefied petroleum gas (LPG), and gasoline. Diesel fuel use about doubled, but the use of gasoline and LPG for pumping irrigation water declined. Pump irrigators can reduce energy costs by irrigating more efficiently. Tail-water recovery for surface-water irrigation systems is becoming very popular and can reduce energy use by 10 to 30 percent. Also, low-pressure center pivot sprinkler systems saved United States farmers an estimated $42 million in energy costs during 1980. (Halterman-PTT)
W86-03233

CROP-WATER PRODUCTION FUNCTIONS AND ECONOMIC IMPLICATIONS FOR THE TEXAS HIGH PLAINS REGION,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
P. G. Hoyt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-149690, Price codes: A03 in paper copy, A01 in microfiche. ERS Staff Report No. AGES820405, April 1982. 30 p, 16 tab, 12 ref.

Descriptors: *Irrigation efficiency, *Irrigation practices, *Water conservation, Water costs, *Cost analysis, Irrigation water, Irrigation requirements, Economic aspects, Corn, Sorghum, Wheat, Aquifer, Crop production, Decision making, Profit.

Crop-water production functions are estimated by growth stage for the major crops of corn, sorghum and wheat grown in the Texas High Plains region. An economic analysis of these production functions provides useful information for making farm-level irrigation decisions to increase profits and conserve water in the Ogallala Aquifer. Results of this study show that irrigators can both save water and increase profits for corn by applying water to maximize profits rather than yields when water prices (costs) are high. Profit maximizing quantities of irrigation water change very little in response to changes in crop or water prices, under conventional delivery and application efficiencies. Increasing irrigation application efficiency decreases water pumped at all water prices, while crop profits are only affected at medium and high water prices. A reduction in well yields of up to 20% has no significant effect on crop profits per acre for corn and wheat, assuming normal precipitation. Profit maximization with well yield reductions of 40% or less will result in lower irrigation application levels and not less land under irrigation, assuming normal precipitation. (Geiger-PTT)
W86-03255

WATER CONSERVATION ALTERNATIVES FOR CALIFORNIA AGRICULTURE: A MICROECONOMIC ANALYSIS,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
S. Kelly, and H. Ayer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-149708, Price codes: A02 in paper copy, A01 in microfiche. ERS Staff Report No. AGES820417, April 1982. 28 p, 11 tab, 11 ref.

Descriptors: *Irrigation efficiency, *Irrigation practices, *Water conservation, *Water costs, *Cost analysis, Irrigation water, Irrigation requirements, Economic aspects, Corn, Cotton, Tomatoes, Crop production, Decision making, Profit, Pricing.

Crop-water production functions for corn, cotton, and tomatoes grown in California are estimated to determine the effects on water use and farm profits of alternative water application levels, changes in irrigation delivery and field efficiencies, and quantity restrictions and changes in water cost on water applications. The production functions show tht short run profits are sharply increased if irrigation field efficiences are increased. Education efforts to reduce irrigation levels will be profitable where the cost of water is medium or high; profits can be increased and water saved if water is medium or high; profts can be increased and water saved if water applications are cut below common practice or the yield maximizing levels. The magnitude of cost savings varies widely based on the source of surface water and the lift depth of pumped water. Educational and management services can encourage farmers to improve field and delivery efficiencies by providing technical and economic data which shows the profitability of efficiency improvement. Improved delivery efficiencies show substantial increases in short run profits in areas of medium to high water prices. The production functions can determine the profit reduction from a 10 or 20% cut in water applications on crops. When very low water prices are increased several fold, water application is reduced by a meaningful amount. (Geiger-PTT)
W86-03256

EFFECTS OF DECREASED WATERING ON WHEAT AND BARLEY YIELDS,
New Mexico Water Resources Research Inst., Las Cruces.
T. W. Sammis, and D. Smeal.
WRRI Report No. 179, January 1983. 72 p, 12 fig, 31 tab, 11 ref, 2 append. 1-4-23652.

Descriptors: *Soil-water-plant relationships, *Water conservation, *Irrigation efficiency, *Water use efficiency, Barley, Wheat, Crop yield, Evapotranspiration, Sprinkler irrigation, Grain crops, Water stress, Stress, Clovis, New Mexico, Agricultural hydrology.

Water resource planners use a water-production function, which is the relationship between yield and evapotranspiration (E) to determine the economic impact of various water allocation decisions. Wheat and barley were irrigated with a range of water levels using a sprinkler-line source to determine yield and evapotranspiration under deficit irrigation. The water-production functions for spring and winter barley were different and varied under different levels of fertilizer. However, expressing the data in terms of relative yield and relative evapotranspiration produced a common water production function. The grain water-production functions for the winter wheat under non-nitrogen stress conditions were the same over years. The average wheat water-production function at Covis, New Mexico, was statistically different from a derived wheat water-production function in Yuma, Arizona. However, when the water-production functions were again expressed in relative yield and relative E terms, the production functions became statistically the same and transferable to either site. The transferability of a water-production function from location to location can be accomplished, when expressed in relative terms, under varying climate conditions and varying fertilizer levels. Water stress also affects the physiological development rate and physiological characteristics of both barley and wheat. The changes in the physiological characteristics of the crops can be used to estimate the resulting decrease in yield caused by moisture stress. (Author)
W86-03289

ADVANCES IN IRRIGATION,
Volume I. Academic Press, New York. 1982, Edited by Daniel Hillel. 302 p.

Descriptors: *Irrigation, *Irrigation practices, *Irrigation programs, *Irrigation efficiency, *Crop production, Models, Irrigation requirements, Water stress, Trickle irrigation, Irrigation water, Drip irrigation, Salt balance, Conjunctive use, Irrigation design, Irrigation canals, Soil moisture meters, Semiarid lands.

This volume is the first of a new serial publication entitled 'Advances in Irrigation'. The new serial is aimed at fulfilling a perceived global need for periodically updated, comprehensive elucidations of the various topics of contemporary interest and importance, related to the rapidly advancing science and engineering practice of irrigation. The contributions used in the serial will include, but not be limited to, state-of-the-art reports, critiques of current practices, economic analyses, case studies of irrigation in difference locations, changing concepts of irrigation, and water-use efficiency. Considerations will be given to such topics as energy and irrigation, controlled-environment crop production, conjuctive use of rainfall and irrigation, and the precise role of irrigation in regional and global food production. Contributions of this first volume cover the following topics: conjunctive use of rainfall and irrigation in semiarid regions, irrigation scheduling using soil moisture measurements(theory and practice), canopy temperature and crop water stress, use of solute transport models to estimate salt balance below irrigated cropland, level-basin irrigation, flow measurement flumes(applications to irrigation), (water management), and principles, practices, and potentialities of trickle (drip) irrigation. (Geiger-PTT)
W86-03398

CONJUNCTIVE USE OF RAINFALL AND IRRIGATION IN SEMIARID REGIONS,
Agricultural Research Service, Bushland, TX. Conservation and Production Research Lab.
B. A. Stewart, and J. T. Musick.
IN: Advances in Irrigation, Volume 1, 1982. 1-24 p, 9 fig, 4 tab, 24 ref.

Descriptors: *Irrigation practices, *Irrigation programs, *Irrigation efficiency, *Conjunctive use, *Semiarid lands, Irrigation, Irrigation requirements, Crop production, Irrigation water, Rainfall, Precipitation, Economic aspects, Soil water, Evapotranspiration, Crop yield.

The conjunctive use of rainfall and irrigation offers considerable potential for increasing water-use efficiency and reducing energy needs for pumping in semiarid regions. Rainfall distributions in semiarid areas of the Central and Southern Great Plains regions of the United States are given. The management strategy of limited irrigation is to optimize production per unit of applied water, rather than to maximize yield per unit of land. Limited irrigation warrants serious consideration as a means of increasing efficient use of water resources for drought-tolerant crops such as sorghum, wheat, cotton, sunflower, and sugar beet. The water-use efficiency is frequently defined as yield per unit amount of evapotranspiration of crops. The conjunctive use of irrigation water and rainfall can be improved indirectly by conservation tillage which decreases runoff, increases infiltration, and reduces evaporation by leaving more crop residues on the soil surface. Specific systems for the conjunctive use of rainfall and irrigation are examined. These

include limited-irrigation-dryland farming, low-energy precision-application, alternating strips of grain sorghum with wheat, tensiometer systems, runoff pits, snow management, crop breeding, anti-transpirants, and irrigated-dryland crop rotations. Management systems used for limited irrigation must be carefully planned to ensure that increased gains in yield due to higher water-use efficiency are not offset by increased production costs in other areas. (Geiger-PTT)
W86-03399

IRRIGATION SCHEDULING USING SOIL MOISTURE MEASUREMENTS: THEORY AND PRACTICE,
Washington State Univ., Pullman. Dept. of Agronomy and Soils.
G. S. Campbell, and M. D. Campbell.
IN: Advances in Irrigation, Volume 1, 1982. p 25-42, 5 fig, 22 ref.

Descriptors: *Irrigation requirements, *Irrigation programs, Irrigation efficiency, *Soil water, *Soil moisture meters, Irrigation, Crop production, Irrigation water, Evapotranspiration, Tensiometers, Monitoring, Models.

The measurement of soil moisture content is probably the oldest method of determining irrigation schedules. Recognition of the fact that the soil water system is dynamic is of fundamental importance in irrigation scheduling. When the soil water content is maintained at values above field capacity, drainage from the profile is rapid, and both water and nutrients are lost. This transition from negligible drainage to appreciable drainage occurs over a narrow range of water contents. The actual water content at which this transition occurs depends on the particular soil. The irrigator must control soil water content so that drainage remains at the value required to meet the objectives of the irrigation. Models were used to calculate soil full and refill points, and the effects of environmental factors on these two points. To schedule irrigation using soil moisture measurements, a site for monitoring soil moisture must be selected, a device for determining the soil water content or potential must be chosen, full and refill points must be set for the particular soil being monitored, and a record-keeping scheme must be established which will show when irrigation is needed and whether overirrigation has occurred. Calibration and recalibration of the neutron probes are described. The soil moisture method of irrigation may be integrated with evapotranspiration and pan evaporation methods to assure that cumulative errors in the climatological scheduling method did not lead to either crop stress or overirrigation. (Geiger-PTT)
W86-03400

CANOPY TEMPERATURE AND CROP WATER STRESS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
R. D. Jackson.
IN: Advances in Irrigation, Volume 1, 1982. p 43-85, 17 fig, 120 ref.

Descriptors: *Infrared radiation, *Water stress, *Irrigation efficiency, *Temperature, *Canopy, Infrared imagery, Irrigation requirements, Plant water potential, Air temperature, Evapotranspiration.

During the first half of the twentieth century, it was suggested that leaf temperatures are always warmer than the air. However, it is now accepted that leaf temperatures and canopy temperatures may be either warmer or cooler than the air, depending upon environmental factors that can for the most part be specified. In the arid areas where irrigation is practiced, temperature techniques work best to predict crop water stress. All temperature-based stress indices assume that only vegetation temperatures are measured. With infrared (IR) thermometry, care must be taken to avoid the complication of the soil background, especially when sparse vegetation is being measured. Critical values of the temperature indices need to be established for various crops. As the development of temperature-based indices progresses, several management factors that need to be considered for certain crops are presented. Advances in IR technology during the past few years have allowed the production of lightweight hand-held IR thermometers that can be used to measure plant canopy temperatures rapidly. Data accumulated so far suggests success in predicting the timing of irrigations to prevent water stress in crops. (Geiger-PTT)
W86-03401

USE OF SOLUTE TRANSPORT MODELS TO ESTIMATE SALT BALANCE BELOW IRRIGATED CROPLAND,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury.
IN: Advances in Irrigation, Volume 1, 1982. p 87-104, 4 fig, 3 tab, 51 ref.

Descriptors: *Models, *Solute tranport, *Irrigation efficiency, *Salt balance, *Drainage water, Model studies, Irrigation requirements, Plant water potential, Crop production, Irrigation.

The state of the art of solute tranport modeling is reviewed and the uses and limitations of models of varying degrees of complexity are discussed in some detail. Solute transport models are useful in describing the movement of salt through the soil, because such in situ field experiments are not feasible due to their time requirements. Solute tranport models differ greatly in complexity and utility, ranging from simple steady-state models which ignore chemical reactions, to complex dynamic models which include all major soil-solution reactions. Three types of solute transport models were applied to the calculation of drainage water composition - the proportional model, the steady-state chemistry model, and the dynamic solute transport model with chemical reactions. In many cases the steady-state assumption will be in error because of the persistence of exchange reactions. During the transitional period or even in steady state, precipitation or dissolution reactions may have an appreciable influence on the salt balance of the drainage water, and calculations based on simple models may be greatly in error. The usefulness of solute transport models to make predictions in field conditions is limited by the inadequacy of water transport models in describing the spatial and temporal distribution of water flow. The solute transport model has its greatest utility as a tool for predicting relative behavior of different irrigation waters, different soil types, or different water management strategies when a scenario for drainage ion composition is produced. (Geiger-PTT)
W86-03402

LEVEL-BASIN IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
A. R. Dedrick, L. J. Erie, and A. J. Clemmens.
IN: Advances in Irrigation, Volume 1, 1982. p 105-145, 24 fig, 3 tab, 34 ref, 1 append.

Descriptors: *Irrigation, *Basin irrigation, *Irrigation practices, *Irrigation design, *Irrigation engineering, Models, Irrigation requirements, Irrigation efficiency, Irrigation programs, Drainage patterns, Infiltration.

In level-basin irrigation, a controlled amount of water is applied to a level soil surface, generally over a short time. Since irregularities in soil infiltration rates or general soil type and land elevation differences may result in uneven distribution of irrigation water, several land preparation measures must be taken. The topsoil should be as uniform as possible. Land grading should include rough grading followed by precision finishing with laser-controlled equipment. The cost of leveling will depend on the amount of soil that must be moved, which is turn is related to field slope and basin size. Design of level basins involves sizing the basins so that a desired distribution uniformity is met for the particular volume of water to be applied (depth of application). The distribution uniformity of a level basin can be functionally described by the Manning equation. When designing level basins a form of the Manning equation has commonly been used. In the Soil Conservation Service design manual for border irrigation, a series of design charts are presented for level basins which relate unit flow rate, basin length, depth of flow, and time of application to distribution uniformity. Theoretical models, such as the zero-inertia model have been developed to predict border irrigation advance and recession. Performance, maintenance and irrigation water delivery systems of border irrigation systems are considered. (Geiger-PTT)
W86-03403

FLOW MEASUREMENT FLUMES: APPLICATIONS TO IRRIGATION WATER MANAGEMENT,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 8B.
W86-03404

PRINCIPLES, PRACTICES, AND POTENTIALITIES OF TRICKLE (DRIP) IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
D. A. Bucks, F. S. Nakayama, and A. W. Warrick.
IN: Advances in Irrigation, Volume 1, 1982. 219-298 p, 35 fig, 11 tab, 200 ref.

Descriptors: *Trickle irrigation, *Drip irrigation, *Irrigation design, *Irrigation operation, Irrigation, Irrigation efficiency, Irrigation practices, Salt balance, Irrigation programs, Hydraulics, Spray irrigation.

Trickle or drip irrigation represents one of the latest innovations in irrigation technology. It was first used in Germany in 1860. Modern trickle irrigation technology dates back to 1964. Trickle irrigation offers more beneficial use of available water, enhanced plant growth and yield, reduced salinity hazard to plants, improved fertilizer and other chemical applications, limited weed growth, reduced operation labor, decreased energy requirements, and improved cultural practices. Potential disadvantages of trickle irrigation include persistent maintenance requirements, salt accumulation near plants, restricted soil water distribution and plant root development, and other economic and technical limitations. Advances in emitters have been made in the trickle, subsurface trickle, bubbler, spray, mechanical move and pulse irrigation systems. Advances in the distribution lines and fittings, system control, water measurement, and automation systems are described. The principles of soil water modeling in relation to trickle irrigation systems are presented. The hydraulics, emission uniformity, and emitter variability of trickle systems are considered. The causes of emitter clogging and preventive maintenance practices are listed. The application of fertilizer and water amendments, irrigation scheduling and crop response, salinity management, water placement and plant rooting, and adaption of cultural practices are examined. Future developments and research in trickle irrigation are discussed. (Geiger-PTT)
W86-03405

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

METHOD OF ESTIMATING FLOOD VOLUMES IN WESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. A. Perry.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4164, 1984. 18 p, 2 fig, 4 tab, 2 ref.

Descriptors: Flood discharge, Flood flows, *Volumetric analysis, *Estimating flood volume, Fore-

casting, *Regression analysis, *Kansas, Crest-stage-indicator gages, *Flood volume.

Relationships between flood volume and peak discharge in western Kansas were developed considering basin and climatic characteristics in order to evaluate the availability of surface water in the area. Multiple-regression analyses revealed a relationship between flood volume, peak discharge, channel slope, and storm duration for basins smaller than 1,503 square miles. The equation VOL=0.536 PEAK1.71 SLOPE-0.85 DUR0.24, had a correlation coefficient of R=0.94 and a standard error of 0.33 log units (-53 and +113 percent). A better relationship for basins smaller than 228 square miles resulted in the equation VOL=0.483 PEAK0.98 SLOPE-0.74 AREA0.30, which had a correlation coefficient of R=0.90 and a standard error of 0.23 log units (-41 and +70 percent). (USGS)
W86-02922

PEAK FLOW, VOLUME, AND FREQUENCY OF THE JANUARY 1982 FLOOD, SANTA CRUZ MOUNTAINS AND VICINITY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. C. Blodgett, and K. R. Poeschel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-583, 1984. 22 p, 6 fig, 5 tab, 7 ref.

Descriptors: *Flood frequency, Flood discharge, Precipitation intensity, Rainfall distribution, *Rainfall-runoff relations, Historic floods, *Peak flow, *California, Santa Cruz Mountains, San Lorenzo River, Santa Cruz.

The areal distribution of precipitation and flooding during the January 1982 storm in the Santa Cruz Mountains and vicinity was influenced by the orographic effect of the Santa Cruz Mountains. Precipitation depths ranged from 12.2 inches in 1 day on the west side to 1.33 inches on the east side. Unit peak discharge ranged from 626 cubic feet per second per square mile on the west side to 83 cubic feet per second per square mile on the east side. The median recurrence interval of peak flow on the west side is 22 years, whereas on the east side it is 6.8 years. Development of a relation between rainfall at Ben Lomond and runoff on the San Lorenzo River at Big Trees shows that the significant climatic factors that describe the flood hydrology of the basin are (1) precipitation for the 3 consecutive days including the day of peak flows and (2) precipitation for a 60-day duration prior to the peak. A study of historical floods and precipitation characterisitica in the San Lorenzo River basin suggests that major floods in the area are the product of (1) greater-than-normal antecedent precipitation for up to 60 days prior to the flood and (2) subsequent intense frontal-type storms immediately prior to the peak. (USGS)
W86-02935

PREDICTIVE SIMULATIONS OF ALTERNATIVES FOR MANAGING THE WATER RESOURCES OF NORTH FORK SOLOMON RIVER VALLEY BETWEEN KIRWIN DAM AND WACONDA LAKE, NORTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W86-02941

FLOOD-DISCHARGE PROFILES OF SELECTED STREAMS IN ROCKLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02960

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--COASTAL RIVER BASINS OF THE SOUTH SHORE AND BUZZARDS BAY,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and M. A. Morgan.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4288, 1985. 30 p, 5 fig, 5 tab, 35 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, South Shore coastal river basins, Buzzards Bay coastal river basins.

The coastal river basins include the minor river basins draining into Massachusetts Bay along the South Shore or into Buzzards Bay. The larger of these basins are the North, South, Jones, Wareham, Weweantic, Mattapoisett, Acushnet, and Slocums River basins. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for data collection sites. Statistics on streamflow characteristics computed with a new data base are presented for six gaged streams. Daily-flow records through 1982 were used to compute annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 49 partial-record sites and procedures used to determine the hydrologic characteristics of the basin are summarized. This gazetteer will aid in the planning and siting of water-resources related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02962

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--THAMES RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and J. A. LeBlanc.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4287, 1984. 27 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Quinebaug River basin, French River basin.

The Thames River basin includes streams draining the Quinebaug River (141 square miles), French River (99.5 square miles), and Middle River (about 6 square miles) basins in south central Massachusetts. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for the first time for streams draining more than 3 square miles and were recomputed for data-collection sites. Streamflow characteristics at seven sites, were calculated using a new data base with daily flow records through 1980. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10 year recurrence intervals. Seven-day low-flow statistics are presented for 32 partial-record sites, and the procedures used to determine the hydrologic characteristics of the basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are provided for seven gaged streams. This gazetteer will aid in the planning and siting of water-resources related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02963

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--BLACKSTONE RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and A. F. Phipps.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4286, 1985. 26 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Blackstone River basin.

The Blackstone River basin encompasses 335 square miles in south-central Massachusetts, including parts of Bristol, Middlesex, Norfolk, and Worcester Counties. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for the first time for streams draining more than 3 square miles and were recomputed for data-collection sites. Streamflow characteristics, were calculated using a new data base with records through 1980. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. The 7-day, 10-year low-flow values are presented for 31 partial-record sites and the procedures used to determine the hydrologic characteristics of the basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for the six gaged streams in the Blackstone River basin. This gazetteer will aid in the planning and siting of water-resources-related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02965

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--HOUSATONIC RIVER BASIN,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and R. G. Lippert.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4285, 1984. 30 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Housatonic River basin.

The Housatonic River basin includes streams that drain 504 square miles in western Massachusetts and 30.5 square miles in eastern New York. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for the first time for streams draining more than 3 square miles and were recomputed for data-collection sites. Streamflow characteristics for four gaged streams were calculated using a new data base with daily flow records through 1981. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 52 partial-record sites, and the procedures used to determine the hydrologic characteristics of the basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are provided for selected gaging stations. This gazetteer will aid in the planning and siting of water-resources related activities and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02966

FLOODS OF MAY 1978 IN SOUTHEASTERN MONTANA AND NORTHEASTERN WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02971

STREAMFLOW CHARACTERISTICS OF MOUNTAIN STREAMS IN WESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.

For primary bibliographic entry see Field 2E.
W86-02972

GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--TAUNTON AND TENMILE RIVER BASINS AND COASTAL RIVER BASINS OF MOUNT HOPE BAY, NARRAGANSETT BAY, AND RHODE ISLAND SOUND,
Geological Survey, Boston, MA. Water Resources Div.
S. W. Wandle, and G. R. Keezer.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4283, 1984. 35 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Drainage area, *Flow duration, *Low flow, *Frequency analysis, Flow characteristics, Streamflow, Surface water, *Massachusetts, Taunton River basin, Tenmile River basin, Mount Hope Bay coastal basins, Narragansett Bay coastal basins, Rhode Island Sound coastal basins.

The study area includes streams draining the Taunton River (562 square miles), the Tenmile River (53.1 square miles), and the minor streams flowing into Mount Hope Bay, Narragansett Bay, and Rhode Island Sound in southern Massachusetts, and adjacent areas of Rhode Island. Drainage areas, using the latest available 1:24,000 scale topographic maps, were computed for the first time for streams draining more than 3 square miles and were re-computed for data-collection sites. Streamflow characteristics, at 10 gaging stations were calculated using a new data base with daily flow records through 1981. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 44 partial-record sites and the procedures used to determine the hydrologic characteristics of a basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for selected gaged streams. This gazetteer will aid in the planning and managing of water-resources related activities, and will provide a common data base for governmental agencies and the engineering and planning communities. (USGS)
W86-02976

MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH SEPTEMBER 1981,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03038

WATER BUDGET FOR MAJOR STREAMS IN THE CENTRAL VALLEY, CALIFORNIA, 1961-77,
Geological Survey, Tahoe City, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03050

DATA COLLECTION FOR A TIME-OF-TRAVEL AND DISPERSION STUDY ON THE COOSA RIVER NEAR CHILDERSBURG, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03052

IMPACTS OF THE TAMPA BYPASS CANAL SYSTEM ON THE AREAL HYDROLOGY, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
R. L. Knutilla, and M. A. Corral.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4222, 1984. 65 p, 32 fig, 7 tab, 32 ref.

Descriptors: Hydrologic systems, Groundwater levels, *Canal construction, Water quality, Streamflow, Springs, *Surface-groundwater relationships, Hillsborough County, *Florida, Tampa Bypass Canal.

Construction of the Tampa Bypass Canal, Florida has resulted in an increase in streamflow from the canal area. Base-flow discharge is more than twice preconstruction amounts. Discharge from springs has decreased by one half or more. Ground-water levels show an increase of up to 4 feet near structure S-160 due to impoundment of water. Elsewhere, levels have generally decreased by 2 to 4 feet. Some minor changes in water quality have occurred. Some of the changes, however, may be attributed to factors other than canal construction. (USGS)
W86-03056

SIMULATED EFFECTS OF PROPOSED RESERVOIR-DEVELOPMENT ALTERNATIVES ON STREAMFLOW QUANTITY IN THE WHITE RIVER, COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
G. Kuhn, and S. R. Ellis.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4297, 1984. 59 p, 18 fig, 6 tab, 13 ref.

Descriptors: *Reservoirs, Streamflow depletion, Hydraulic models, *Reservoir effects, *Water resources development, Minimum flow, Simulation analysis, White River, Avery Reservoir, Powell Park Reservoir, Taylor Draw Reservoir, White River Reservoir, *Colorado, *Utah.

Numerous reservoirs have been proposed for the White River basin in Colorado and Utah, primarily to provide water for oil-shale development. A multireservoir-flow model was used to simulate the effects of streamflow withdrawal at four of the proposed reservoirs using historical streamflow data from the 1932-81 water years. The proposed reservoirs considered in the study were Avery, Powell Park, Taylor Draw, and White River Reservoirs; construction of Taylor Draw Dam was completed during the study. Annual streamflow depletions from the White River ranging from about 93,000 to 226,000 acre-feet were simulated for the 50 year period. Simulated streamflow throughout the year generally became smaller and more constant as streamflow throughout the year generally became smaller and more constant as streamflow depletion increased. Minimum streamflow requirements would not have been met for a maximum of 13 years and water-use requirements associated with the proposed reservoirs would not have been met for a maximum of 3 years. The current water-use pattern, which depletes about 40,000 acre-feet per year and is dominated by irrigation of hay meadows and pastureland, was maintained in the simulation. Relations between reservoir active capacity and yield applicable to the White River also were developed. These relations show that reservoir storage of about 400,000 acre-feet is the maximum practicable for the White River. (USGS)
W86-03061

PRELIMINARY INVESTIGATION OF FLOW CHARACTERISTICS OF THE ALABAMA RIVER UPSTREAM FROM SELMA, ALABAMA,
Geological Survey, Montgomery, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03077

FLOOD FREQUENCY AND STORM RUNOFF OF URBAN AREAS OF MEMPHIS AND SHELBY COUNTY, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
B. L. Neely.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4110, 1984. 51 p, 10 fig, 7 tab, 13 ref.

Descriptors: *Floods, *Regional floods, *Regression analysis, *Peak discharge, *Tennessee, Gaging stations, Hydraulic design, Flood frequency, Flood hydrographs, *Memphis, Shelby County, *Rainfall-runoff model.

Techniques are presented for estimating the magnitude and frequency of peak discharges and storm runoff on stream in urban areas of Memphis, Tennessee. Comprehensive analyses were made in which physical characteristics of streams are related to snythetic flood characteristics at gaging stations. Equations derived from analyses provide estimates of peak discharges with recurrence intervals of 2 to 100 years on streams that have drainage areas less than 20 square miles. The regression analyses indicated that size of drainage area and condition of channel (paved or unpaved) are the most significant basin characteristics affecting the magnitude and frequency of floods in urban streams. Data from 27 gaging stations with 8 years of record were used in the analyses. Flood frequency at each gaging station was computed from calibrated parameters in a rainfall-runoff model. Techniques are also presented for estimating discharge hydrographs for individual floods by using the unit hydrograph, lag time, and rainfall excess. (USGS)
W86-03078

FLOODING IN NORTHWESTERN HILLSBOROUGH AND SOUTHERN PASCO COUNTIES, FLORIDA, IN 1979,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03109

FRESHWATER RUNOFF AND SALINITY DISTRIBUTION IN THE LOXAHATCHEE RIVER ESTUARY, SOUTHEASTERN FLORIDA, 1980-82,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2L.
W86-03118

EVALUATION OF THE EFFECTS OF LAKE AUDUBON ON GROUND- AND SURFACE-WATER LEVELS IN THE LAKE NETTIE AREA, EASTERN MCLEAN COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03140

GENERALIZED SKEW COEFFICIENT FOR FLOOD FREQUENCY COMPUTATIONS FOR THE STATE OF HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03143

STORAGE ANALYSIS FOR EPHEMERAL STREAMS IN SEMIARID REGIONS,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03171

WATER RESOURCES DATA, TEXAS, WATER YEAR 1982, VOLUME 3; COLORADO RIVER, LAVACA RIVER, GUADALUPE RIVER, NUECES RIVER, RIO GRANDE BASINS AND INTERVENING COASTAL BASINS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03208

Group 4A—Control Of Water On The Surface

WATER RESOURCES DATA, OKLAHOMA WATER YEAR 1982,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03217

WEATHERING TESTS CONDUCTED ON SOIL STABILIZERS: INTERIM REPORT,
Bureau of Reclamation, Denver, CO.
W. R. Morrison, and Z. D. Fedotova.
A Water Resource Technical Publication, U.S./U.S.S.R. Joint Studies on Plastic Films and Soil Stabilizers, December 1984. 83 p, 55 fig, 14 tab.

Descriptors: *Erosion control, *Erosion, *Vegetation establishment, Bank erosion, Soil erosion, Soil stability, Weathering, Revegetation, Vegetation regrowth, Vegetation, Soil stabilization.

Studies on soil stabilizer specimens in the form of crusts or films formed as a result of treatment of sandy slopes of a drainage canal are described. The joint U.S. and U.S.S.R. program involved testing a means of stabilizing slopes or reclamation (drainage) canals by direct sowing of perennial grass (without emplacement of a fertile layer of soil and raking in of seeds), accompanied by application of polycomplexes to the surfaces of sands, sandy, and sandy-loam soils. the coatings retain their protective qualities under the effects of alternating wetting and drying; they do not soften or fail, are resistant to torrential rains, spring floods and wind velocities of 24 to 30 m/s. The grass seeds grow freely in the first year, with an average shoot density of 3600 to 4100/sq m. The economic aspects of the reclamation of canal banks is discussed. (Halterman-PTT)
W86-03247

HERBICIDAL RESIDUES AND ENVIRONMENTAL EFFECTS FROM THE EXPERIMENTAL APPLICATION OF TWO 2,4-D FORMULATIONS TO CONTROL EURASIAN WATERMILFOIL,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
N. E. Otto, J. C. Pringle, and D. Sisneros.
Available from Engineering and Research Center, Denver, CO. Report No. REC-ERC-83-1, July 1983. 97 p, 24 fig, 27 tab, 2 app, 15 ref.

Descriptors: *Herbicide residues, *Environmental effects, *Weed control, *Aquatic weed control, *Toxicity, Eurasian Watermilfoil, Water analysis, Chemical analysis, Water quality, Limnology, Bioaccumulation, Oklahoma.

In response to the need for an effective and environmentally acceptable herbicide to control erosian watermilfoil, a serious aquatic weed problem, an interagency research study was initiated involving the USBR (Bureau of Reclamation) and the COE (U.S. Army Corps of Engineers). This document reports the tolerance and label amendment efforts done by the USBR. Experimental small-plot applications of 2,4-D dimethylamine (DMA) and butoxyethanol ester (BEE) at rates of 20 and 40 lb/acre (22.5 and 45 kg/ha) were made at Banks Lake, Washington and Fort Cobb Reservoir, Oklahoma with subsequent water, hydrosoil, invertebrate organism, and dish flesh sample collection and analysis for residues, through 56-days posttreatment. The temporary potable water tolerance of 0.1 mg/L (0.1 p/m) was exceeded in three 1-day posttreatment samples (of 1680 water samples analyzed) or 0.18% of the total samples. No dichlorophenols were found in water, but dimethylnitrosamines in the microgram/L range were detected in a few pretreatment and posttreatment samples from both sites. Hydrosoil 2,4-D residues were low, with concentrations ranging from 0 to 0.316 micrograms/g in DMA treated areas and a maximum of 37 micrograms/g of soil resulting from a 45 kg/ha (40 lb/acrea) BEE application. Trace amounts of 2,4-D dichlorophenol in the microgram/L range were found in some hydrosoil pretreatment and posttreatment samples. Herbicide residues in fish flesh were well within the 1 mg/L (1 p/m) food additive tolerance, with no evidence of bioaccumulation.
W86-03327

4B. Groundwater Management

SIMULATED GROUND-WATER FLOW IN THE POTOMAC AQUIFERS, NEW CASTLE COUNTY, DELAWARE,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02920

WATER-SUPPLY POTENTIAL OF THE FLORIDAN AQUIFER IN OSCEOLA, EASTERN ORANGE, AND SOUTHWESTERN BREVARD COUNTIES, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02924

ESTIMATION OF VERTICAL HYDRAULIC CONDUCTIVITY OF THE CLAY LAYER BETWEEN THE EUTAW AND GORDO AQUIFERS IN THE VICINITY OF FAUNSDALE, MARENGO COUNTY, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02925

MODEL PROJECTIONS, 1980-99, FOR ARKANSAS RIVER VALLEY, HAMILTON AND KEARNY COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02928

WATER QUALITY OF A STREAM-AQUIFER SYSTEM, SOUTHERN FRANKLIN COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02931

HYDROGEOLOGIC DATA FROM A TEST WELL IN EAST-CENTRAL DUVAL COUNTY, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
D. P. Brown, R. A. Johnson, and R. A. Broxton.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-802, 1985. 61 p, 18 fig, 3 tab, 4 ref.

Descriptors: Observation wells, Groundwater, *Subsurface investigations, Saline-water intrusion, Confined aquifers, *Hydrogeology, Well logging, *Test wells, *Florida, Duval County, Jacksonville, Floridan aquifer system.

A 2,112-foot test well was drilled in east-central Duval County, Florida, to obtain geologic, hydrologic, and water chemistry data. Drill cuttings and water samples were collected, and water-level measurements and lithologic and geophysical logs were made. Deposits to a depth of 575 feet consist of sand, clayey sand, phosphatic sandy clay, coquina, sandy limestone, and dolostone. Below 575 feet, the deposits consist of fragmented and granular limestone, dolomitic limestone, and massive to finely crystalline dolostone, which comprise the Floridan aquifer system in the area. Water levels were measured near or at the bottom of the drill hole through the drill stem and in the annular space between the drilled hole and drill stem at the well head as drilling progressed from 770 to 2,112 feet in depth. Water levels measured through the drill stem ranged from 1.17 feet above land surface at a depth of 2,107 feet to 15.0 feet above land surface at a depth of 1,574 feet. Water levels measured in the annular space ranged from 7.5 feet above land surface at a depth of 770 feet to 14.9 feet at various depths from 1,574 to 1,721 feet. Chloride concentrations of water sampled through the drill stem from a depth of 711 to 1,616 feet ranged from 22 to 150 milligrams per liter at 1,648 feet. Chloride concentrations then ranged from 345 to about 800 milligrams per liter to a depth of 2,071 feet and then increased to a maximum of 5,450 milligrams per liter at 2,107 feet. (USGS)
W86-02938

SURFICIAL AQUIFER IN PINELLAS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02946

GROUND-WATER SYSTEM AND SIMULATED EFFECTS OF GROUND-WATER WITHDRAWALS IN NORTHERN UTAH VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02948

FEASIBILITY OF ARTIFICIAL RECHARGE IN THE COASTAL PLAIN NEAR ATLANTIC CITY, NEW JERSEY, WITH EMPHASIS ON THE 800-FOOT SAND OF THE KIRKWOOD FORMATION,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02949

PROJECTED WATER-LEVEL DECLINES IN THE OGALLALA AQUIFER IN LEA COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02952

APPLICATION OF THE CONJUGATE-GRADIENT METHOD TO GROUND-WATER MODELS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02954

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART II, GEOHYDROLOGIC MAPS OF THE TERTIARY AQUIFERS AND RELATED CONFINING LAYERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02956

AVAILABILITY OF GROUND WATER IN THE OUTWASH AQUIFER, MARION COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02958

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER IN KANSAS, 1970,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02970

HYDROGEOLOGY OF THE CLAYTON AQUIFER OF SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02995

GEOCHEMICAL SURVEY TO DETERMINE WATER-QUALITY CHARACTERISTICS OF THE BIG SIOUX AQUIFER IN EASTERN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03019

GEOHYDROLOGY OF ROCKS PENETRATED BY TEST WELL UE-25PNO1, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03024

EFFECTS OF ARTIFICIAL RECHARGE ON AN ALLUVIAL AQUIFER, OGALLALA FORMATION, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
R. F. Brown, and W. S. Keys.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2251, 1985. 56 p, 67 fig, 7 tab, 26 ref.

Descriptors: *Artificial recharge, *Aquifer characteristics, *Hydrogeology, Borehole geophysics, Well logging, Groundwater movement, *Ogallala Formation, *Texas.

Four recharge tests were conducted by injecting water from playa lakes through wells into the Ogallala Formation. Injection was by both gravity flow and pumping under pressure. At one site, 34-acre feet of water was injected by gravity which produced a significant increase in yield of the well. At a second site, gravity injection of only 0.58 acre-foot caused a significant decrease in permeability due to plugging of the aquifer by suspended sediment. At two other sites, injection by pumping 6 and 14 acre-feet respectively, resulting in discharge of water at the surface and in perching of water above the water table. Difference in success of recharge were largely due to: lithology and, therefore, the type of permeability; the concentration of suspended solids in the recharge water; and the injection technique. The injection technique can be controlled and the concentration of suspended solids can be minimized by treatment, but the site for well recharge will accept water most rapidly if it is selected on the basis of a favorable geohydrologic environment. Geophysical logs were used to study the effect of aquifer lithology on recharge and to understand the movement of injected water. Temperature logs were particularly useful in tracing the movement of recharged water. Natural-gamma, gamma-gamma, and neutron logs provided important data on lithology and porosity in the aquifer and changes in porosity and water distribution resulting from recharge. Effective recharge of the Ogallala Formation, using water from playa lakes, is possible where geohydrologic conditions are favorable and the recharge system is properly constructed. (USGS)
W86-03032

PRINCIPLE OF SUPERPOSITION AND ITS APPLICATION IN GROUND-WATER HYDRAULICS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03040

GROUND-WATER LEVELS IN WYOMING, 1974 THROUGH 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03046

PROPOSED ARTIFICIAL RECHARGE STUDIES IN NORTHERN QATAR,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03058

TEST WELLS IN CENTRAL WASHINGTON, 1977-79: DESCRIPTION AND RESULTS,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03062

SELECTED HYDROGEOLOGIC DATA FOR THE BIG MUDDY CREEK VALLEY NEAR PLENTYWOOD, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-406, 1985. 22 p, 3 fig, 5 tab.

Descriptors: *Groundwater, *Water quality, Well logs, *Hydrologic data, Data collections, *Montana, Plentywood.

Selected hydrogeologic data have been compiled for the Big Muddy Creek valley near Plentywood. The data pertain to most of the known municipal, commercial, and domestic wells drilled in the valley. The data include records of 59 wells and 19 test holes, 21 chemical analyses of water samples, and 40 logs describing lithology penetrated during drilling operations. (USGS)
W86-03068

HYDROGEOLOGIC APPRAISAL OF FIVE SELECTED AQUIFERS IN ERIE COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03084

GEOHYDROLOGY OF THE AQUIFER IN THE SANTA FE GROUP, NORTHERN WEST MESA OF THE MESILLA BASIN NEAR LAS CRUCES, NEW MEXICO,
Geological Survey, Las Cruces, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03088

TEST WELLS T27 AND T28 WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO,
Geological Survey, Las Cruces, NM. Water Resources Div.
R. G. Myers, and K. M. Pinckley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-809, 1985. 19 p, 3 fig, 5 tab, 2 ref.

Descriptors: *Observation wells, *Groundwater data, Borehole geophysical logs, Lithologic logs, Driller's logs, *New Mexico, Dona Ana County, Tularosa Basin, White Sands Missile Range.

Two test wells, T27 and T28, were drilled at White Sands Missile Range in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in February and March 1983. Test wells T27 and T28 were drilled as observation wells in the vicinity of the Liquid Propellant Storage Area. Information obtained from these wells includes lithologic logs, driller's logs, and borehole-geophysical logs from the cased wells. (USGS)
W86-03089

TEST WELLS T23, T29, AND T30, WHITE SANDS MISSILE RANGE AND FORT BLISS MILITARY RESERVATION, DONA ANA COUNTY, NM,
Geological Survey, Las Cruces, NM. Water Resources Div.
R. G. Myers, and K. M. Pinckley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-805, 1985. 23 p, 3 fig, 4 tab, 3 ref.

Descriptors: *Observation wells, *Test holes, *Groundwater data, Borehole geophysical logs, Lithologic logs, *New Mexico, Dona Ana County, Tularosa Basin, Fort Bliss Military Reservation, White Sands Missile Range.

Three test wells, T23, T29, and T30, were drilled in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in November 1982. Test well T23 was drilled as an exploratory and monitoring well in the proposed Soledad well field at the Fort Bliss Military Reservation. Test wells T29 and T30 were drilled at White Sands Missile Range. Test well T29 was drilled as an observation well in the vicinity of the outfall channel from the sewage treatment plant. Test well T30 was drilled as an observation well for a landfill south of the well site. Information obtained from these wells includes lithologic logs for all wells and borehole-geophysical logs from the cased wells for test wells T29 and T30. (USGS)
W86-03090

GROUNDWATER LEVELS IN NEBRASKA, 1983,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03094

TEST WELL DO-CE 88 AT CAMBRIDGE, DORCHESTER COUNTY, MARYLAND,
Geological Survey, Trenton, NJ. Water Resources Div.
H. Trapp, L. L. Knobel, H. Meisler, and P. P. Leahy.
Available from Dist Branch, USGS, 604 S. Pickett St., Alexandria, VA 22034. USGS Water-Supply Paper 2229, 1984. 48 p, 13 fig, 20 tab, 36 ref.

Descriptors: *Test wells, *Coastal aquifers, Saline-freshwater interfaces, Piezometric head, Well logs, Water quality, *Aquifer testing, Hydraulic properties, *Groundwater, Clay minerals, Geologic formations, Dinoflagellates, Foraminifers, Palynology, Core logging, Well drilling, Geothermal studies, Groundwater movement, Minerals, Cation exchange, Aquifer characteristics, Specific capacity, Temperature effects, Tidal effects, Chemical analysis, *Maryland, Dorchester County, Maryland, Atlantic Coastal Plain, Core squeezing.

The test well DO-CE at Cambridge, M, penetrated 3,299 feet of unconsolidate Quaternary, Tertiary and Cretaceous sediments and bottomed in quartz monzonite gneiss. It provides data for a study of the aquifer system of the northern Atlantic Coastal Plain. Twenty-one cores were collected. Six sand zones were tested for aquifer properties and their waters sampled. Heads measured at seven depths indicate upward flow. A temperature log showed a maximum temperature of 41.9 degrees Celsius and a mean temperature gradient of 27.5 degrees Celsius/kilometer. Water analyses delineated the freshwater-saltwater transition zone between 2,650 and 3,100 feet. The ground water changes progressively downward from a sodium bicarbonate to a sodium chloride character. Clays in the analyzed core samples belong to the montmorillonite and kaolinite groups, and mean cation exchange capacity ranged from 8.3 to 38.9 milliequivalens/100 grams. Vertical and horizontal hydraulic conductivities measured in sediment cores ranged from 0.0000015 to 1.3 feet/day and from 0.0000073 to 1.3 feet/day, respectively. Porosity ranged from 22.4 to 41 percent. From aquifer tests, transmissivities ranged from 25 to 850 feet squared/day and horizontal hydraulic conductivities ranged from 2.5 to 85 feet/day. Fossils in core samples include palynomorphs, dinoflagellates, and foraminifers. (USGS)
W86-03098

HYDROGRAPHS FROM SELECTED OBSERVATION WELLS AND TOTAL ANNUAL

PUMPAGE FROM MUNICIPAL SUPPLY WELLS, 1950-83, SANTA FE, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03101

DEVELOPMENT OF A TWO-DIMENSIONAL DIGITAL MODEL FOR THE ANALYSIS OF THE GROUND-WATER FLOW SYSTEM IN THE SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03108

POTENTIAL GROUND-WATER LEVEL CHANGES IN THE MISSISSIPPI RIVER ALLUVIAL AQUIFER IN RESPONSE TO PROPOSED NAVIGATION IMPROVEMENTS ON THE YAZOO RIVER IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03122

HYDROLOGY OF THE OGALLALA AQUIFER IN FORD COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03128

GROUND-WATER-LEVEL TRENDS IN IDAHO, 1971-82,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03129

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1982,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03204

REHABILITATION OF A CALCIUM CARBONATE CLOGGED DRAINAGE SYSTEM USING SULFAMIC ACID,
Bureau of Reclamation, Billings, MT. Upper Missouri Region.
G. M. Walker.
REC-ERC-85-2, October 1984, 9 p, 3 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Scaling, *Subsurface drains, *Acids, Cleaning, *Clogging, Cost analysis, Calcium carbonate, Drains, Drainage systems, Drainage engineering, Subsurface drainage, Irrigation engineering.

The restoration of subsurface irrigation drains is a problem when drain water has deposited calcium carbonate scale. Methods for restoration of these drains such as mechanical routing and sulfur dioxide gas treatment are expensive and dangerous. A technique was developed for cleaning drains in which the drains are flooded with a 10% sulfamic acid-sodium chloride solution. The present method costs less than a fifth of the replacement cost. The cost of treating a severely plugged 240-mm drainage pipe would range between $3 and $6 per meter. Sulfamic acid is not considered to be a hazardous material when neutralized before disposal, and is available in granular form, making it safe to transport and use. The ease of use and lower costs of the sulfamic acid-sodium chloride method should make this method an attractive option for drainage systems of projects of the Bureau of Reclamation. (Geiger-PTT)
W86-03268

4C. Effects On Water Of Man's Non-Water Activities

RELATIONS OF URBAN LAND-USE AND DRY-WEATHER STORM AND SNOWMELT FLOW CHARACTERTISTICS TO STREAM-WATER QUALITY, SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
L. M. Pope, and H. E. Bevans.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-750, 1984. 64 p, 12 fig, 11 tab, 21 ref.

Descriptors: *Water quality, *Urban runoff, *Storm runoff, *Land use, Urbanization, Streamflow, Trace metals, Nutrients, Rainfall, Rainfall intensity, *Kansas, Topeka, Shunganunga Creek.

Water-quality characteristics of streams draining Topeka, Kansas, and the Shunganunga Creek basin were investigated from October, 1979, through November 1981, to determine the effects of runoff from urban areas. Characteristics were determined at six sites and summarized statistically for three streamflow conditions-dry weather, storm, and snowmelt. Median concentrations of trace metals and nutrients were greater in storm streamflow than in dry-weather streamflow. Regression equations were developed to estimate median concentrations of total lead and zinc in storm streamflow from the percentage of drainage area in residential plus commercial land-use areas and from street density. Median concentrations of dissolved sodium, chloride, and solids were considerably greater in snowmelt streamflow than in dry-weather streamflow. Regression equations were also developed to estimate median concentrations of dissolved sodium, chloride, and solids from the summation of percentages of the drainage area in residential, commercial, and industrial land-use areas and from street density. Multiple-regression analysis relating storm-runoff volumes and average constituent concentrations to land-use and storm characersitcs produced significant relations for storm-runoff volume, total lead, total zinc, and suspended sediment. (USGS)
W86-02926

RAINFALL-RUNOFF DATA IN THE ALBUQUERQUE, NEW MEXICO, METROPOLITAN AREA, 1976-83,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02933

HYDROLOGY OF AREA 61 NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02934

HYDROLOGY OF AREA 45, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, MONTANA AND NORTH DAKOTA,
Geological Survey, Helena, MT. Water Resources Div.
S. E. Slagle.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Open File Report 83-527, 1984. 90 p, 44 fig, 11 tab, 169 ref.

Descriptors: Groundwater, Surface water, Coal, Coal mines, *Strip mines, Spoil banks, *Coal mine effects, *Water quality, *Groundwater quality, Hydrogeology, *Montana, *North Dakota, Northern Great Plains, Williston Basin, Fort Union Formation.

Area 45 encompasses about 14,300 square miles in east-central Montana and west-central North Dakota and is drained by the Missouri, Yellowstone, and Redwater Rivers and their tributaries. During low-flow intervals, the water in streams generally is of the sodium sulfate type with dissolved-solids concentrations of 1,000 to 3,000 mg/L. During direct-runoff periods, the relative proportions of calcium and bicarbonate increase and dissolved-solids concentration typically is 150 to 600 mg/L. These high dissolved concentrations in streams of this area are naturally occuring and not ordinarily a result of coal mining. Principal water-yielding units are the Fox Hills-lower Hell Creek, Tullock, Tongue River, and alluvial aquifers. Wells completed in the Fox Hills-lower Hell Creek aquifer may yield as much as 400 gal/min. Wells in other bedrock aquifers commonly yield 8 to 15 gal/min. Yields to wells in alluvial aquifers commonly are 30 gal/min or less but may be several hundred gallons per minute along major streams. Water from aquifers less than about 200 feet deep is generally of the sodium sulfate type. Dissolved-solids concentration averages about 1,700 mg/L. Water from the Fox Hills-lower Hell Creek aquifer generally is of the sodium bicarbonate type and has an average dissolved-solids concentration of about 1,200 mg/L. (USGS)
W86-02959

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE HORSE CREEK AREA, SHERIDAN AND MOORHEAD COAL FIELDS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4239, 1985. 61 p, 14 fig, 8 tab, 29 ref.

Descriptors: Hydrology, Coal mines, Reclamation, *Coal mining, Environmental impact, Water development effects, Hydrogeology, *Montana, *Powder River Basin.

The Horse Creek area of the Sheridan and Moorhead coal fields, 16 miles east of the Decker Coal Mines near the Tongue River, contains large reserves of Federally owned coal that have been identified for potential lease sale. A hydrologic study was conducted in the area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Hydrologic data collected from private wells, observation wells, test holes, and springs indicate that the aquifers are primarily coal and sandstone beds in the upper part of the Tongue River Member of the Fort Union Formation (Paleocene age) and sand and gravel of valley alluvium (Pleistocene and Holocene age). Surface-water resources are mostly limited to a few stock ponds receiving discharge from springs in the higher ports of the area. Two stock wells, one spring, and three stock ponds receiving discharge from springs supply most of the water used within the Horse Creek basin; the only use is watering of livestock. Mining of the Anderson and Dietz coal beds would destroy one stock well and two ponds receiving discharge from springs, and would lower the potentiometric surface within the coal and sandstone aquifers. Although mining would alter existing hydrologic systems, alternative deeper water supplies are available. (USGS)
W86-02968

FLOODFLOW CHARACTERISTICS OF FILBIN CREEK AT PROPOSED INTERSTATE HIGHWAY 526, NORTH CHARLESTON, SC,
Geological Survey, Columbia, SC. Water Resources Div.
L. R. Bohman.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4323, 1984. 20 p, 7 fig, 4 tab, 7 ref.

Descriptors: *Flood profiles, *Highway effects, Reservoir routing, Hydrologic models, Model

studies, *South Carolina, North Charleston, Filbin Creek.

A study to determine the impact of two alternative construction plans for proposed interchange between the existing Interstate Highway 26 and Interstate Highway 526 in the Filbin Creek drainage basin near North Charleston, South Carolina was performed by the U.S. Geological Survey, in cooperation with the South Carolina Department of Highways and Public Transportation. A computerized reservoir routing technique was used to route synthetic flood hydrographs through the basin system. Simulation results indicate that the new roadway will cause little or no change in water-surface elevations downstream of Interstate Highway 26. Upstream of Interstate Highway 26, approximately 0.5 foot of backwater will be created by either alternative during a 100-year flood as a result of the Interstate Highway 526 embankments and structures. (USGS)
W86-02969

USE OF SELECTED BASIN CHARACTERISTICS TO ESTIMATE MEAN ANNUAL RUNOFF AND PEAK DISCHARGES FOR UNGAGED STREAMS IN DRAINAGE BASINS CONTAINING STRIPPABLE COAL RESOURCES, NORTHWESTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
H. R. Hejl.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4260, 1984. 17 p, 2 fig, 2 tab, 12 ref.

Descriptors: Annual runoff, Flood peak, *Flood frequency, Flood recurrence interval, *Flow characteristics, Regression analysis, Statistical methods, *Basin charateristics, *Coal mining, *New Mexico, San Juan Basin.

Equations in this report can be used to estimate mean annual runoff and peak discharges for 2-, 5-, 10-, 25-, and 100-year recurrence intervals for ungaged streams in drainage basins containing strippable coal resources in northwestern New Mexico. These streamflow characteristics are related to basin characteristics that were found to be significant, using regression techniques. Mean annual runoff for ephemeral streams is related to drainage area, active-channel width, main-channel slope, basin slope, and silt-clay percentage in active-channel banks. Peak discharges for ephemeral, intermittent, and perennial streams are related to drainage area, active-channel width, main-channel length, basin slope, and silt-clay percentage in active-channel banks. (USGS)
W86-02978

GROUND-WATER-QUALITY DATA FROM THE SOUTHERN POWDER RIVER BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-03014

STORM RUNOFF AS RELATED TO URBANIZATION BASED ON DATA COLLECTED IN SALEM, AND PORTLAND, AND GENERALIZED FOR THE WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
A. Laenen.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4143, 1983. 88 p, 16 fig, 16 tab, 19 ref.

Descriptors: *Rainfall, Runoff, *Urbanization, *Storm runoff, Basin characteristics, Salem, *Urban hydrology, *Urban runoff, Willamette Valley, *Oregon.

Storm runoff as related to urbanization is defined by a series of regression equations for Salem and for the Willamette Valley, Oregon. In addition to data from 17 basins monitored in the Salem area, data from 24 basins gaged in a previous study in Portland, Oregon - Vancouver, Washington were used defining the Willamette Valley equations. Basins used to define equations ranged in size from 0.2 to 26 square miles. Rainfall intensity varied from 1.8 to 2.2 inches for the 6 hour, 0.2 exceedance probability. Sensitivity analyses of equations indicate that urbanization of an undeveloped basin can increase peak discharge more than three times and almost double runoff volume. Much of Portland and Vancouver are located on porous river terraces where dry wells are used to shunt runoff. Much of East Salem is located on previously farmed land where drain tiles used to dewater soils still connect directly to streams. (USGS)
W86-03015

WATER RESOURCES AND POTENTIAL HYDROLOGIC EFFECTS OF OIL-SHALE DEVELOPMENT IN THE SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. L. Lindskov, and B. A. Kimball.
Dist Branch, USGS, 604 S. Pickett St., Alexandria, VA 22034. USGS Professional Paper 1307, 1984. 32 p, 20 fig, 3 tab, 55 ref.

Descriptors: Water resources, *Oil shale, *Water quality, *Salinity, Colorado River compact, *Mining effects, *Colorado, Uinta Basin, Green River Formation,Synfuels, Upper Colorado River Region.

Normal annual precipitation varies with altitude from less than 8 inches at altitudes below 5,000 feet to more than 20 inches where altitudes exceed 9,000 feet. In areas where precipitation is less than 10 inches, streams are ephemeral. Mean annual runoff is about 28,000 acre-feet and varies from less than 0.1 to 1.6 inches. Runoff varies yearly and seasonally, and potentially evapotranspiration exceeds precipitation. The White and Green Rivers convey an average flow of 4.3 million acre-feet per year from an outside drainage of 34,000 squqre miles, more than 150 times the flow originating in the area. Total recoverable groundwater in storage is about 18 million acre-feet. Yields of individual wells and interference between wells cound limit withdrawals to about 15,000 acre-feet per year. A 400,000-barrel-per-day oil-shale industry would require a water supply of 70,000 acre-feet per year. Other sources of water supply discussed are diversion from the White River, a proposed reservoir on the White River, diversion from the White River combined with proposed off-stream storage, diversion from the Green River, and conjunctive use of ground and surface water. Leachate water from retorted-shale piles has large concentrations of sodium and sulfates, and retort waters contain much organic carbon and nutrients. Without proper disposal of these water, the natural waters of the area could be contaminated and the salinity of downstream waters in the Colorado River Basin could be increased. (USGS)
W86-03021

FLOOD-PROFILE ANALYSIS, BIG DARBY CREEK AT STATE ROUTE 762, ORIENT, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
W. P. Barlett, and J. M. Sherwood.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4276, 1984. 12 p, 4 fig, 3 tab, 5 ref.

Descriptors: *Flood profiles, *Bridge construction, Backwater, *Big Darby Creek, *Ohio, Backwater.

The U.S. Geological Survey, in cooperation with the Ohio Department of Transportation, made a hydraulic analysis of the 25- and 100-year floods on Big Darby Creek where State Route 762 crosses the stream at Orient, Ohio. Two proposed bridge plans were analyzed to determine the effects of placing a new deck bridge upstream of the existing State Route 762 bridge. In plan 1, the bridge is set at sufficient elevation to pass the 100-year flood below it. In plan 2, the elevations are 3 feet lower than in plan 1, which would result in partial submergence of the bridge during the 100-year flood. This analysis shows that the 25-year flood upstream of the new bridge would increase by 0.4 foot if plan 1 is adopted and by 0.3 foot if plan 2 is adopted. The profiles for the 100-year flood would increase by 0.6 foot for plan 1 and 1.1 feet for plan 2. This additional backwater affects profiles up to 5,750 feet upstream, where the plan 1 profile is 0.1 foot higher than for present conditions and the plan 2 profile is 0.2 foot higher than profiles for present conditions. (USGS)
W86-03027

SYNTHESIZED FLOOD FREQUENCY FOR SMALL URBAN STREAMS IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03037

DETERMINING THE EFFECTIVENESS OF HIGHWAY DRAINAGE SYSTEMS IN PREVENTING SALT CONTAMINATION OF GROUND WATER,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W86-03044

STREAMFLOW IN THE SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03064

CLASSIFICATION OF STREAM BASINS IN SOUTHEASTERN OHIO ACCORDING TO EXTENT OF SURFACE COAL MINING,
Geological Survey, Columbus, OH. Water Resources Div.
C. J. O. Childress.
Available from Dist Branch, USGS, 604 S. Pickett St. Alexandria, VA 22034. USGS Water-Resources Investigations Report 84-4212, 1985. 83 p, 7 fig, 8 tab, 26 ref.

Descriptors: Water quality, *Coal mines, *Mine drainage, *Land reclamation, Land use, Surface water, Analysis of variance, Mine water, Coal mining effects, *Ohio, Discriminant function analysis, Surface coal mining.

Water-quality data were collected to rank streams draining 35 basins in the southeastern Ohio coal region according to severity of impact from acid mine drainage. The area is underlain by rocks of Pennsylvania age, the most important coal-producing formations being the Allegheny and the Monongahela. Water and bed-material samples were collected at 276 sites; each site was sampled four times over a 3-year period. By means of land-use maps, each site was classified as 'mined-abandoned,' 'mined-relcaimed,' 'unmined,' or 'mixed.' Streams draining the carbonate-bearing Monongahela Formation have a significantly greater buffering capacity than streams draining the Allegheny Formation. There were significant differences in specific conductance, pH, alkalinity, acidity, hardness, total and dissolved iron, manganese, and aluminum; dissolved nickel, zinc, and sulfate; and dissolved solids among mining disturbance types in the Allegheny Formation. However, in streams draining the more calcareous Monongahela Formation, only dissolved solids, hardness, sulfate, and dissolved manganese were significantly different among mining-disturbance types. Discriminant-function analysis of water-quality data was used to classify each mixed site into one of 10 categories ranging from strongly characteristic of abandoned-mine areas to strongly characteristic of unmined areas. (USGS)
W86-03071

URBAN WATER-QUALITY DATA AND STATISTICAL SUMMARIES FOR SELECTED SITES IN THE SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03099

CALCULATING SEDIMENT DISCHARGE FROM A HIGHWAY CONSTRUCTION SITE IN CENTRAL PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A Reed, J. R. Ward, and K. L. Wetzel.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4216, 1985. 12 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Road construction, *Sediment discharge, Sediment prediction, Sediment modeling, Rainfall, Soil erosion, *Pennsylvania, *Highway construction, Discharge, Sediment yield.

Two methods used by the Pennsylvania Department of Transportation to compute the quantity of sediment discharged from an area of highway construction--the Universal Soil Loss Equation and the Younkin Sediment Prediction Equation--were evaluated. Data used in the analysis included the total rainfall, kinetic energy, and the erosive index (EI) of the precipitation, and highway construction data including the area disturbed by clearing and grubbing, the area in cuts and fills, the average depth of cuts and fills, the area seeded and mulched, and the area paved. Sediment yields, calculated using the two equations, were compared to the actual measured values, and standard errors of estimate and coefficients of correlation were calculated. Using the USLE, the standard error of estimate was 0.40, (about 105 percent), and the coefficient of correlation was 0.79. Using the Younkin Equation, the standard error of estimate was 0.42 (about 110 percent), and the coefficient of correlation was 0.77. (USGS)
W86-03102

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1982,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03106

HYDROLOGY OF AREA 29, EASTERN REGION, INTERIOR COAL PROVINCE, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03111

EFFECTS OF HYDRAULIC BOREHOLE MINING ON GROUND WATER AT A TEST SITE IN NORTHEAST ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. S. Hampson.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4149, 1984. 29 p, 12 fig, 10 tab, 3 ref.

Descriptors: *Hydraulic mining, *Ground water, *Injection wells, *Mining engineering, Phosphates, *Hydraulic borehole mining, Phosphate mining.

An experimental mining project was conducted in northeast St. Johns County, Florida, to determine the feasibility of extracting deeply buried phosphate ore by hydraulic borehole mining techniques. The phosphate zone is between 232 and 250 feet below land surface and consists of approximately equal proportions of fine-grained phosphate, sand, and clay. Six wells were constructed at the test site to monitor effects of the mining operation on the ground-water resources of the area. One well penetrated the Floridan aquifer beneath the phosphate zone, another was completed in the phosphate zone, and the other four were finished in water-bearing zones above the phosphate zone. The mining project consisted of three separate tests in which different mining methods were used. Changes in water levels, other than in the mined zone, were detected only in the overlying monitored zone during the first two tests as a result of roof failures in cavities formed by the mining operation. Water-quality changes were observed only in the mined zone and resulted from the injection of water from the deeper Floridan aquifer as part of the mining operation. (USGS)
W86-03116

POTENTIAL HYDROLOGIC IMPACTS OF A TARSAND INDUSTRY IN 11 SPECIAL TAR SAND AREAS IN EASTERN UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 6D.
W86-03141

WYCOALGAS COAL GASIFICATION PROJECT: PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 1,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5C.
W86-03271

4D. Watershed Protection

RECONNAISSANCE STUDY OF STREAM SEDIMENTAION, SOUTHERN GUAM,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-03112

ESTIMATES OF LONG-TERM SUSPENDED-SEDIMENT LOADS IN BAY CREEK AT NEBO, PIKE COUNTY, ILLINOIS, 1940-80,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-03138

WEATHERING TESTS CONDUCTED ON SOIL STABILIZERS: INTERIM REPORT,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 4A.
W86-03247

HANDBOOK FOR PROTECTION OF FISH AND WILDLIFE FROM CONSTRUCTION OF FARM AND FOREST ROADS,
Center for Natural Areas, South Gardiner, ME.
For primary bibliographic entry see Field 6B.
W86-03257

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER-QUALITY RECONNAISSANCE AND STATISTICAL ANALYSIS FOR SELECTED WATER-SUPPLY LAKES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
L. M. Pope, J. A. Arruda, and A. E. Vahsholtz.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4058, 1985. 47 p, 1 fig, 9 tab, 16 ref.

Descriptors: *Lakes, *Water quality, *Land use, Lake morphology, Watersheds, Nutrients, Nitrates, Total organic carbon, Chlorophyll a, Statistical analysis, *Kansas, Pollutant identification.

Data collected for 19 public water-supply lakes in eastern Kansas during spring-fall 1983 were statistically analyzed to describe relationships between water-quality constituents and lake and watershed physical characteristics. A large range was observed in mean concentrations of total nitrite plus nitrate nitrogen, total ammonia nitrogen, total phosphorus, total organic carbon, and chlorophyll a and in lake and watershed physical characteristics, such as age, surface area, watershed area, watershed-to-lake surface-area ratio, and average maximum depth. Pesticides were detected in 8 of the 19 lakes. Atrazine and Alachlor were the most commonly detected pesticides. Spearman rank-order correlation analyses showed possible relationships between mean concentrations of total nitrite plus nitrate nitrogen, total ammonia nitrogen, total phosphorus, total organic carbon, and chlorophyll a, and certain lake and watershed physical characteristics. Multiple-regression analysis produced significant relations between mean concentrations of total nitrite plus nitrate nitrogen and percentage of watershed in protected cropland and age of lake (0.62 coefficient of determination), and between mean concentrations of total organic carbon and lake average maximum depth, lake-surface area, age of lake, and watershed-to-lake surface-area ratio (0.76 coefficient of determination). (USGS)
W86-02927

WATER QUALITY OF A STREAM-AQUIFER SYSTEM, SOUTHERN FRANKLIN COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-02931

HYDROLOGIC EFFECTS OF IMPOUNDMENTS IN SHERBURNE NATIONAL WILDLIFE REFUGE, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02939

HYDROLOGY OF AREA 45, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, MONTANA AND NORTH DAKOTA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02959

WATER QUALITY OF THE TIDAL POTOMAC RIVER AND ESTUARY HYDROLOGIC DATA REPORTS SUPPLEMENT 1979 THROUGH 1981 WATER YEARS,
Geological Survey, Reston, VA. Water Resources Div.
R. H. Coupe, and W. F. Webb.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-132, 1984. 66 p, 4 fig, 9 tab, 29 ref.

Descriptors: *Biochemical oxygen demand, *Fecal coliforms, *Fecal streptococci, *Sewage treatment plants, Incident light, Light attenuation, *Potomac River, *Potomac Estuary, Pollutant identification.

This report is a companion report to the U.S. Geological Survey 1979, 1980, and 1981 Hydrologic Data Reports of the tidal Potomac River and Estuary. It contains values of biochemical oxygen demand and specific rate constants, incident light and light attenuation measurements; numbers of phytoplankton, fecal coliform and fecal streptococci, cross-sectional averages from field measurements of dissolved oxygen, pH, specific conductance, and temperature data; and cross-sectional averages of chlorophyll data. Sewage treatment plant loads are also included. (USGS)
W86-02997

INDEX OF GROUND-WATER QUALITY DATA FOR FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03002

RESULTS OF THE U.S. GEOLOGICAL SURVEY'S SECOND INTERNATIONAL INTERLABORATORY ANALYTICAL COMPARISON STUDY--STANDARD-REFERENCE WATER SAMPLES M-86 (MAJOR CONSTITUENTS), T-87 (TRACE CONSTITUENTS), AND P-5 (PRECIPITATION SNOWMELT),
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03013

GROUND-WATER-QUALITY DATA FROM THE SOUTHERN POWDER RIVER BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-03014

COMPILATION OF GROUND WATER QUALITY DATA IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03026

WATER-RESOURCES MONITORING IN THE COTTONWOOD CREEK AREA, SHASTA AND TEHAMA COUNTIES, CALIFORNIA, 1982-83,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03054

FIELD GUIDELINES FOR COLLECTION, TREATMENT, AND ANALYSIS OF WATER SAMPLES, MONTANA DISTRICT,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-03060

FILTRATION AND COLUMN-ADSORPTION SYSTEM FOR ONSITE CONCENTRATION AND FRACTIONATION OF ORGANIC SUBSTANCES FROM LARGE VOLUMES OF WATER,
Geological Survey, Lakewood, CO. Water Resources Div.
J. A. Leenheer, and T. I. Noyes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Supply Paper 2230, 1984. 15 p, 4 fig, 1 tab, 12 ref.

Descriptors: *Organic matter, Fulvic acids, *Water analysis, Adsorption, Separation techniques, Filtration, *Chemical analysis, *Analytical methods, Dissolved organic carbon fractionation, Organic solute isolation techniques.

A portable filtration and column-adsorption system was developed, which can concentrate suspended sediment and dissolved-aqueous organic substances onsite. Organic solutes also are fractionated into hydrophobic- and hydrophilic-acid, base, and neutral fractions. Subsequent isolation of organic solutes from fraction concentrates and extraction of organic constituents in suspended sediment entrained on filter tubes is performed by a variety of procedures in the laboratory. Three surface-water samples and one ground-water sample ranging in volume from 300 to 1,000 liters were processed through the filtration and column-adsorption system, yielding from about 0.8 to 3.0 grams of recovered organic carbon per sample. (USGS)
W86-03065

PREPARATION OF POLYETHLENE SACKS FOR COLLECTION OF SAMPLES FOR CHEMICAL ANALYSIS,
Geological Survey, Lakewood, CO. Water Resources Div.
L. J. Schroder, and A. W. Bricker.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4067, 1985. 9 p, 4 tab, 11 ref.

Descriptors: *Adsorption, Atomic absorption, *Spectroscopy, Specific conductance, *Sampling, *Water analysis, Iron, Lead, Zinc, Hydrogen ion concentration.

Polyethylene sacks are used to collect precipitation samples. Washing polyethylene with acetone, hexane, methanol, or nitric acid can change the adsorptive characteristics of the polyethylene. In this study, simulated precipitation at pH 4.5 was in contact with the polyethylene sacks for 21 days; subsamples were removed for chemical analysis at 7, 14, and 21 days after intitial contact. Sacks washed with acetone adsorbed iron and lithium; sacks washed with hexane adsorbed barium, iron, and lithium; sacks washed with methanol adsorbed calcium and iron; and sacks washed with 0.30 N nitric acid adsorbed iron. Leaching the plastic sacks with 0.15 N nitric acid did not result in 100-percent recovery of any of the adsorbed metals. Washing polyethylene sacks with dilute nitric acid caused the pH of the simulated precipitation to be decreased by 0.2 pH unit after 1 week of contact with the polyethylene. The specific conductance increased by 10 microsiemens per centimeter. Contamination of precipitation samples by lead was determined to be about 0.1 microgram per liter from contact with precleaned polyethylene sacks. No measurable contamination of precipitation samples by zinc occurred. (USGS)
W86-03072

GROUND-WATER QUALITY APPRAISAL OF SURFICIAL SAND-PLAIN AQUIFERS IN HUBBARD, MORRISON, OTTER TAIL, AND WADENA COUNTIES, MINNESOTA,
Geological Survey, Grand Rapids, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03080

SELENIUM CONCENTRATIONS IN WATERS TRIBUTARY TO AND IN THE VICINITY OF THE KESTERSON NATIONAL WILDLIFE REFUGE, FRESNO AND MERCED COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
T. S. Presser, and I. Barnes.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4122, 1984. 26 p, 4 fig, 3 tab, 21 ref.

Descriptors: *Water pollution sources, *Pollutant identification, *Wildlife, *Selenium, *California, *Water analysis, *Sodium sulfate, *Thenardite, Kesterson National Wildlife Refuge.

Analyses were made for selenium in waters and other materials of the Kesterson National Wildlife Refuge. Analyses were also made of source agricultural drainage waters from the San Luis Drain discharged into the refuge, and surrounding irrigation supply and return waters. Selenium concentrations range from 140 to 1,400 micrograms per liter (microgram/L) in irrigation drain waters supplied to the San Luis Drain. The selenium supplied to the Kesterson National Wildlife Refuge is to a small extent precipitated in sodium sulfate (thenardite) but a higher concentration was found in an alagal mat. Most other waters of the area contain less than detectable < 2 micrograms per liter concentrations of selenium. Oxidation of organic matter and reduction of selenate to selenite were found to be necessary for a quantitative analysis of total selenium. (USGS)
W86-03124

DATA COMPILATION OF BENTHIC INVERTEBRATES FROM TRIBUTARY STREAMS OF THE YAMPA AND NORTH PLATTE RIVER BASINS, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5C.
W86-03126

EVALUATION OF GROUND-WATER QUALITY DATA FROM KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-03142

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN NORTHEASTERN MISSISSIPPI, AUGUST 1983,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-03162

RECONNAISSANCE OF BENTHIC INVERTEBRATES FROM TRIBUTARY STREAMS OF THE YAMPA AND NORTH PLATTE RIVER BASINS, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
L. J. Britton.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4191, 1983. 73 p, 20 fig, 25 tab, 31 ref.

Descriptors: *Water quality, *Coal-mining, Aquatic insects, *Benthic invertebrates, *Biological water quality statistical relationships, Pollutant identification, *Colorado, Yampa River Basin, North Platte River Basin.

Benthic invertebrates were collected from tributaries of the Yampa River in Routt and Moffat Counties, and tributaries of the North Platte River in Jackson County. Field water-quality measurements of water temperature, specific conductance, pH, dissolved oxygen, and bed material size were also made to aid in assessing stream water-quality conditions. The purpose of the study was to describe and quantify the benthic invertebrate communities in selected streams in coal mining areas. Stream sampling sites were located upstream and downstream from potential, existing, or historical coal mining areas. Sampling was conducted on a near bimonthly basis throughout the growing season, beginning in April and May 1980, and continuing through September 1981. The density of benthic invertebrates generally increased downstream in all streams sampled. Most of the variation in densities and taxa among the stream sites was associated with sampling date differences. There were also some strong correlations of benthic invertebrate densities with measured water-quality constituents and properties. However, a larger sample size (greater frequency of sampling) may influence this relation. (USGS)
W86-03167

OVERVIEW OF GROUND-WATER QUALITY DATA IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
P. A. Kammerer.
USGS Water-Resources Investigation Report 83-4239, 1984. 58 p, 16 ref.

Descriptors: *Groundwater, *Water quality, *Groundwater pollution, *Waste disposal, *Wastewater lagoons, Landfills, Evaluation, Geohydrologic units, Groundwater quality appraisal, *Wisconsin, Contamination, Data evaluation.

This report contains a summary of ground-water-quality data for Wisconsin and an evaluation of the adequacy of these data for assessing the impact of land disposal of wastes on ground-water quality. Chemical analyses used in data summaries were limited to those stored in the USGS computer

system (WATSTORE). Information on documented instances of ground-water contamination and sources of potential contamination from land disposal of wastes was provided by the Wisconsin Department of Natural Resources. Available data provide an overview of ground water quality but may be insufficient for assessment of ground-water contamination from land disposal of wastes. Many sources of potential ground-water contamination (landfills, surface waste-storage impoundments, and buried tanks) are known. Some of these are probably causing local ground-water contamination that is not apparent from available regional data. Information needs for assessment of groundwater contamination from land disposal of wastes include improved understanding of both groundwater hydrology and the chemical behavior of specific contaminants in the environment. (USGS)
W86-03177

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1982,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-03204

NEW INSTRUMENTATION FOR AIRBORNE ACID-RAIN RESEARCH,
Brookhaven National Lab., Upton, NY. Environmental Chemistry Div.
For primary bibliographic entry see Field 7B.
W86-03242

PRESENCE OF PATHOGENIC MICROORGANISMS IN POWER PLANT COOLING WATERS: REPORT FOR OCTOBER 1, 1979, TO SEPTEMBER 30, 1981,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W86-03243

MONITORING AND ANALYSIS OF HAZARDOUS ORGANICS IN MUNICIPAL WASTEWATER - A STUDY OF TWENTY-FIVE TREATMENT PLANTS,
Municipal Environmental Research Lab., Cincinnati, OH.
S. A. Hannah, and L. Rossman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-155613, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/D-82-376, November 1982, 32 p, 10 fig, 8 tab, 12 ref.

Descriptors: *Water pollution, *Wastewater treatment, *Wastewater, *Wastewater analysis, Wastewater composition, Wastewater facilities, Treatment plants, Organic wastes, Organic compounds, Hazardous materials, Toxicity, Sludge.

A discussion is presented of a research program with the following objectives: (1) to develop sensitive analytical methods capable of analyzing municipal wastewater and sludges for 114 organic priority pollutants and (2) to survey 25 publicly owned treatment works for the toxic organics. Development of the analytical methods and results of the survey are discussed. Plant selection criteria included plant size and type, geographical location and industrial contributions to the municipal wastewater. Raw wastewaters, primary effluents, final discharges and sludges were sampled. The majority of the plants were found to have between 20 and 50 priority organics in their raw influents and 10 to 30 priority organics in their final discharges. Only 15 compounds were found at concentrations above 1 microgram/l in wastewaters (or 1 mg/kg in sludge) at least 80 percent of the time in raw wastewaters and at least 50 percent of the time in final plant discharges and sludges. Significance of the findings as related to proposed Water Quality Criteria for both toxic organics and metals are addressed. (Author)
W86-03262

DEVELOPMENT OF A SYSTEM FOR THE IDENTIFICATION OF OIL SPILLS,
Sentralinstitutt for Industriell Forskning, Oslo (Norway).
R. G. Lichtenthaler, P. E. Paus, I. Andresen, H. Guthenberg, and T. Haegh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-132597, Price codes: A03 in paper copy, A01 in microfiche. 77 12 09-3, Technical Report, August 31, 1982. 39 p, 1 fig, 1 tab, 7 ref. 77 12 09.

Descriptors: *Pollutant identification, *Oil pollution, *Oil spills, *Gas chromatography, *Spectroscopy, Infrared spectroscopy, X-ray spectroscopy, Nickel, Vanadium, Sampling, Atomic absorption spectroscopy, Heavy metals.

A system for the identification of oil spilled at sea is proposed. The system includes oil sampling procedures and analytical methods. Hydrocarbon compounds are studied by ultraviolet or ultraviolet-fluorescence-spectroscopy, low resolutions gas chromatography, high resolution gas chromatography and infrared-spectroscopy; the contents of Ni and V are determined by atomic absorption spectroscopy; the contents of S are determined by X-ray-fluorescence spectroscopy or by combustion and titration. Criteria for the evaluation of results and standardized reporting are presented. (Author)
W86-03286

DETECTION OF POLLUTION AT DRINKING WATER INTAKES,
Water Research Centre, Medmenham (England). Medmenham Lab.
G. P. Evans, and D. Johnson.
IN: Environmental Protection: Standards, Compliance, and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 239-254 p, 3 fig, 2 tab, 26 ref.

Descriptors: *Aquatic environment, *Environmental protection, *Public health, Toxicity, Monitoring, Environmental management, Drinking water, Potable water, Fish, Bioassay.

It is predicted that by the end of this century, 60% of the water supplied in the United Kingdom will be provided by lowland river intakes. At present, there are about 100 annual drinking water intake closures due to pollution incidents in the supplying rivers. The pollutants involved are fuel oils 40% of the time, 10% farm wastes, 10% sewage, 5% plating effluent, 5% phenols, and 30% of the incidents are due to other chemicals from industry and road accidents. The purpose of this paper is to discuss early detection of pollution incidents which will allow managers of water treatment plants to make appropriate decisions in order to safeguard both the consumer and the plant. Conventional pollutant monitoring of such parameters as dissolved oxygen, temperature, pH, ammonia, nitrate, organic matter and turbidity can be on a continuous basis, and fed directly into micro-computer systems. The use of captive fish as a broad-based monitor, whole cell and enzyme systems, oil slick indicator instruments and system integration are also available for detection of non-conventional, non-specific pollutant monitoring. (Halterman-PTT)
W86-03359

WATER ANALYSIS, VOLUME III: ORGANIC SPECIES,
Academic Press, Inc., Orlando, FL. 1984. Edited by Roger A. Minear and Lawrence H. Keith. 456 p.

Descriptors: *Pollutant identification, *Water analysis, *Wastewater analysis, *Organic compounds, Oxygen demand, Sample preparation, Chromatography, Mass spectrometry, Infrared spectroscopy.

Many techniques are available for determining the organic constituents of water and wastewater. Useful nonspecific determinations include BOD, COD, total organic carbon. In addition to bottle tests, laboratories use respirometers, carbon analyzers, spectrophotometry, and electrochemical methods. Concentration, partitioning, and isolation techniques may involve solvent extraction, sorption from water, solvent evaporation, distillation and evaporation, freeze concentration, membrane techniques, adsorption, ultrafiltration, precipitatin, and bubble concentration. For the purpose of concentration, compounds are roughly divided into volatile, semivolatile, low molecular weight nonvolatile, and high molecular weight. For complex unknown mixtures several systemmatic isolation and concentration schemes have been developed. Gas chromatography is a popular and fast-advancing method for complex mixture analysis. Mass spectrometry is most often used to identify unknown organic compounds in environmental samples. High performance liquid chromatography is the most valuable technique for separation and analysis of nonvolatile organic constituents in water. Theoretical and practical aspects of infrared spectrophotometry for water analysis are discussed. (Cassar-PTT)
W86-03406

WASTE STRENGTH AND WATER POLLUTION PARAMETERS,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. C. Young.
IN: Water Analysis, Volume III: Organic Species, 1984. 1-39 p, 12 fig, 4 tab, 90 ref.

Descriptors: *Pollutant identificaiton, *Wastewater analysis, *Organic compounds, *Biochemical oxygen demand, *Oxygen demand, Organic matter, Mathematical models, Model studies, Nitrification, Dilution, Aeration, Respirometers, Warburg respirometer, Barcroft respirometer, Sampling, Sample preservation, Dissolved oxygen, Nutrients, Hydrogen ion concentration.

Nonspecific or indirect tests for the gross amount of organic matter in wastewater are essential for wastewater management. Although the BOD test is time consuming and relatively imprecise, it is the only parameter that distinguishes between biodegradable and nonbiodegradable organic matter. The 5-day BOD test is widely recognized as the standard BOD. During the first 5-7 days the carbonaceous material is degraded, followed by oxidation of nitrogenous compounds (nitrogen demand). The ultimate oxygen demand is the sum of carbonaceous and nitrogen demand. A plateau and a lag may be evident in the BOD test. The plateau may be a result of endogenous respiration of bacteria and other processes; the lag may occur when insufficient acclimated microorganisms are present. The BOD reaction has been modeled by first- or second-order equations, nitrification reactions, and other models. BOD test methods have several forms: standard dilution test, reaeration technique, short-term total biochemical oxygen demand test, respirometers (Warburg, Barcroft, other modified manometric type, oxygen-depletion, and electrolytic), and rapid or alternative. Many factors affect BOD test data: sampling procedure, sample storage and preservation, sample characteristics, mixing, seeding, dilution, dilution technique, dilution water quality, pH, mineral nutrients, method of dissolved oxygen measurement, dissolved oxygen concentration, toxicity, and nitrification. Accuracy and precision vary widely. Lowest coefficients of variability are obtained with respirometers. (Cassar-PTT)
W86-03407

CHEMICAL NONSPECIFIC ORGANICS ANALYSIS,
Florida International Univ., Miami. Drinking Water Research Center.
W. J. Cooper, and J. C. Young.
IN: Water Analysis, Volume III: Organic Species, 1984. p 41-82, 6 fig, 10 tab, 52 ref.

Descriptors: *Pollutant analysis, *Water analysis, *Wastewater analysis, *Organic compounds, *Chemical oxygen demand, Organic carbon, Dissolved organic carbon, Total organic carbon, Volatile organic carbon, Monitoring, Automation, Amines, Carbohydrates, Halogens, Oxygen demand, Spectrophotometry, Electrochemistry.

Nonspecific methods for determining the organics content of aqueous solutions are suitable as screening procedures to minimize use of more complex analyses. Total organic carbon may be determined

as total organic carbon (TOC), dissolved organic carbon (DOC), particulate organic carbon (POC), and volatile organic carbon (VOC). Three techniques are used for this purpose: wet oxidation, dry combustion, and direct injection, high-temperature oxidation. A table lists some commercial carbon analyzers and their characteristics. Sources of error are inorganic salts and acids, loss or volatile organics during acidification, heavy metals, and instrument variations. Organic halogens are determined by several techniques, including instrumental methods. The chemical oxygen demand test uses an oxidant such as potassium dichromate. Reagent remaining after oxidation is titrated, and the amount of carbon is calculated. COD tests have been developed into rapid forms and automated forms. The main sources of error in COD tests are incomplete oxidation of the organic compounds, vaporization of compounds, insufficient reflux or heating time, unsuitable sample size and preparation, and interference from chlorides and other inorganics. Total oxygen demand methods more nearly approximate the theoretical oxygen demand of a sample. spectrophotometric methods and electrochemical methods are also available for measuring organics in water. Specific reagent systems are available to determine amines and carbohydrates. Carbon and total oxygen demand analyzers are also adaptable to on-line monitoring. (Cassar-PTT)
W86-03408

CONCENTRATION, PARTITIONING, AND ISOLATION TECHNIQUES,
Geological Survey, Denver, CO. Water Resources Div.
J. A. Leenheer.
IN: Water Analysis, Volume III: Organic Species, 1984. p 83-166, 19 fig, 4 tab, 260 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Wastewater analysis, Sample preparation, Ion exchange, Sorption, Membrane processes, Solvent extractions, Evaporation, Distillation, Freezing, Reverse osmosis, Dialysis, Bubbles, Chemical precipitation, Adsorption, Ultrafiltration, Gel filtration, Filtration, Activated carbon.

The most significant developments in concentration, partitioning, and isolation techniques for organic constituents of water include (1) the sparge-and-trap technique for volatile analyses, (2) the development and use of synthetic resin adsorbents, and (3) applications of high performance liquid chromatography to sample concentration, fractionation, and cleanup. Important aspects of determining analytes at very low levels involve selection of organic-free equipment, sample handling to prevent organic contamination, and preparation of organic-free reagent water, chemical reagents, sorbents, and membranes. Techniques are described for volatiles, semivolatiles, low molecular weight nonvolatiles, and high molecular weight constituents. The techniques of sparge-and-trap, solvent extraction, and sorption from water are applied to volatiles concentration. For semivolatiles, the following may be used for sample concentration: solvent extraction, sorption from water (ion exchange), water distillation and evaporation, freezing, membranes, adsorptive bubble separation, and vacuum sublimation. Practical concentration techniques for low molecular weight nonvolatiles include sorption (ion exchange), adsorptive bubble separation, solvent extraction, water evaporation, reverse osmosis, precipitation, and freezing. Although high molecular weight compounds (e.g., humic and fulvic acids) are least characterized at the structural level, they abound in dissolved and colloidal organic fractions. Concentration methods involve adsorption, ultrafiltration and gel filtration, precipitation and coprecipitation, and water evaporation. Comprehensive and systematic schemes for concentrating, partitioning, and isolating constituents from a complex mixture are described. (Cassar-PTT)
W86-03409

GAS CHROMATOGRAPHY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
R. P. Schwarzenbach, W. Giger, and K. Grob.
IN: Water Analysis, Volume III: Organic Species, 1984. p 167-251, 25 fig, 5 tab, 226 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Chromatography, Gas chromatography, Surfactants, Pesticides, Hydrocarbons, Trihalomethanes, Chlorinated hydrocarbons, Aromatic hydrocarbons, Phenols.

Gas chromatography is the most important analytical technique for determination of individual organic compounds in the aquatic environment. Many variations in equipment and techniques are available for adaptation to the analyst's needs. Capillary gas chromatography requires more skill in operation than packed-column chromatography, but it is more sensitive and selective. Three types of injection techniques are available: vaporizing, cold (introduced as a liquid), and cold introduction with ballistic heating. Injection methods and their problems are discussed: the syringe needle, split injection, splitless injection, and cold on-column injection. Capillary columns are discussed in detail: problems, column qualities and tests, stationary phases, carrier gases, end-piece treatment, and diagnosis of defects. Detector systems include flame ionization, electron capture, alkali flame ionization, flame photometric, thermal conductivity, electrochemical, photoionization, microwave plasma emission, and mass spectrometer. Substances which can be detected qualitatively or quantitatively in aqueous systems are volatile halogenated hydrocarbons, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, phenols, pesticides, triglycerides, low-molecular weight acids, surfactants, and complex mixtures. (Cassar-PTT)
W86-03410

ORGANIC MASS SPECTROMETRY,
National Inst. of Environmental Health Sciences, Research Triangle Park, NC.
J. R. Hass, and D. L. Norwood.
IN: Water Analysis, Volume III: Organic Species, 1984. p 253-316, 20 fig, 106 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Spectrometry, Mass spectrometry, Chromatography, Gas chromatography.

This chapter reviews the basic principles of organic mass spectrometry, instrumentation, and data interpretation and describes recent developments in the field. Ionization may take place by electron impact or chemical means. Low-volatility samples present special problems in ionization; techniques used are (1 chemical derivatization to form a more volatile substance or (2) methods such as field desorption and surface ionization. Several mass analyzers are available. Quadropole mass filters are most widely used. Others include magnetic sectors and double-focusing mass analyzers. The time-of-flight mass spectrometer uses a pulse of ions accelerated through a source-voltage difference. Electron multipliers detect the ions; these come in two varieties, venetian blind and continuous dynode. Mass spectrometry combined with either gas or liquid chromatography has been a powerful tool in organics analysis. For detection of single components in complex mixtures (e.g., dioxin in environmental samples), tandem mass spectrometry, also known as mass spectrometry/mass spectrometry, is used. Qualitative analysis of unknown mixtures involves a series of steps; this process has been somewhat simplified by computers and spectrum library files. Gas chromatography has decreased the use of mass spectrometry in quantitative analysis. However, coupling the two methods is receiving more attention. Some applications in the field of water analysis include detection of trace organic pollutants and the substances adsorbed by activated carbon filters. (Cassar-PTT)
W86-03411

USE OF HPLC FOR WATER ANALYSIS,
Radian Corp., Austin, TX.
K. J. Bombaugh.
IN: Water Analysis, Volume III: Organic Species, 1984. p 317-379, 11 fig, 7 tab, 65 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Chromatography, Liquid chromatography, High performance liquid chromatography.

High pressure/performance liquid chromatography (HPLC), valuable for analyzing nonvolatile substances, has great potential for water analysis. The equipment consists of several components: carrier delivery systems (pumps), carrier gradient systems (mixing), sample inlet systems (injection), and column hardware and housing. Many detectors are available for use with HPLC: photometric, spectrophotometric, refractive index, fluorometric, photoconductivity, electrical conductivity, and electrochemical. Two basic problems in HPLC are solute band retention and spreading of the bands. Resolution, the extent to which chromatographic peaks are separated, can be optimized by increasing relative retention (column selectivity) and retention (capacity factor) and by reducing band spreading (column efficiency). HPLC systems can be classified into several types: normal-phase (porous sorbent with nonpolar carrier), reversed-phase (polar mobile phase and nonpolar stationary phase), paired-ion (conversion of ionic substances to lipophilic liquids that distribute between conventional LC phases), ion-exchange (pH-controlled aqueous carriers and ionically charged packings), and size-exclusion (separated according to molecule size). Directions are given for making a separation and optimizing it. (Cassar-PTT)
W86-03412

INFRARED SPECTROPHOTOMETRY OF POLLUTANTS IN WATER SYSTEMS,
Breidenbach Environmental Research Center, Cincinnati, OH.
F. K. Kawahara.
IN: Water Analysis, Volume III: Organic Species, 1984. p 381-443, 12 fig, 9 tab, 99 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Spectroscopy, *Infrared spectroscopy, Hydrocarbons, Aromatic compounds, Amines, Amino acids, Nitrogen compounds, Nitrates, Nitrites, Chlorinated hydrocarbons, Fluorine compounds, Organophosphorus compounds, Sulfur compounds, Sulfides, Pesticides, Phenols, Oil spills, Statistical analysis.

Infrared spectroscopy relies on the interaction of infrared light of known frequency and intensity with molecules. This paper discusses the theoretical aspects, considering molecular spectra, band positions, types of vibrations, and interactions. Conditions necessary for interpreting spectra are described. Spectra may be compared with spectra of known functional groups. Types of bands and spectra are covered under alkanes (methyl and methylene groups), branched-chain hydrocarbons, olefins (carbon-carbon double bonds and carbon-hydrogen bonds), aromatics (carbon hydrogen bonds and ring carbon-carbon bonds), alcohols and phenols (oxygen-hydrogen bond, carbon-oxygen bond, and hydroxyl group), ethers, epoxides, peroxides, carbonyl compounds (aldehydes, ketones, carboxylic acids and salts, esters, acyl and aroyl halides, amides, anhydrides, lactams, and lactones), amines (nitrogen-hydrogen bonds and carbon-nitrogen bonds), amine salts, amino acids and salts, nitriles and isonitriles, nitro compounds, nitrates, nitrites, organohalogens (carbon-fluorine and carbon-chlorine), organophosphorus compounds, and organosulfur compounds. Detailed information is given for infrared analysis of pesticides, phenol, and petroleum products, in particular, oil spills. Statistical analysis has been applied to infrared analysis in linear discriminant function analysis. Fourier transform infrared spectroscopy has permitted higher sensitivity and/or greater speed in analysis of trace water pollutants. (Cassar-PTT)
W86-03413

5B. Sources Of Pollution

GEOHYDROLOGY OF THE MADISON AND ASSOCIATED AQUIFERS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,

Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02921

EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING MAJOR DISSOLVED-ION YIELDS OF STREAMS IN THE UNITED STATES,
Geological Survey, Doraville, GA. Water Resources Div.
N. E. Peters.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Supply Paper 2228, 1984. 39 p, 18 fig, 9 tab, 88 ref.

Descriptors: *Multivariate analysis, *Denudation, Streams, *Weathering, Crystalline rocks, Carbonate rocks, Sandstones, Atmospheric precipitation, *Geochemistry, Population density, *Dissolved solids, *Ions, Chemical transport, *Ion transport.

The seven dissolved major ions in streams (sodium, potassium, magnesium, calcium, chloride, sulfate, and bicarbonate) and their sum dissolved solids, from 56 basins in the conterminous United States and Hawaii were correlated with bedrock type, annual precipitation, population density, and average stream temperature of their respective basins through multiple linear regression equations to predict annual yields. Yields from basins underlain by limestone, sandstone, or crystalline rock ranged from about 10 to 100,000 kilograms per square kilometer. Predicted yields were within 1 order of magnitude of measured yields. The most important factor in yield prediction was annual precipitation, which accounted for 58 to 71 percent of all yields. Rock type was second in importance. Population density was ineffective indicator of all constituents except sodium and chloride, for which it accounted for 13 and 20 percent of the annual yield, respectively. Furthermore, average ion contributions from atmospheric deposition accounted for 30 percent of the sodium and chloride and 60 percent of the sulfate in annual yields. (USGS)
W86-02923

RELATIONS OF URBAN LAND-USE AND DRY-WEATHER STORM AND SNOWMELT FLOW CHARACTERTISTICS TO STREAM-WATER QUALITY, SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02926

WASTEWATER APPLICATION BY SPRAY IRRIGATION ON A FIELD SOUTHEAST OF TALLAHASSEE, FLORIDA: EFFECTS ON GROUND-WATER QUALITY AND QUANTITY, 1980-82,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Elder, J. D. Hunn, and C. W. Calhoun.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4006, 1985. 41 p, 20 fig, 5 tab, 40 ref.

Descriptors: Municipal wastewater, Wastewater management, *Wastewater irrigation, *Spray irrigation, *Groundwater pollution, Groundwater level, Water quality, *Florida, Tallahassee.

A field southeast of Tallahassee, Florida, used for land application of wastewater by spray irrigation was the site of a ground-water monitoring study to determine effects of spray irrigation on water-table elevations and ground-water quality. The study was conducted during 1980-82 in cooperation with the City of Tallahassee. The wastewater has relatively high concentrations of chloride, nitrogen, phosphorus, organic carbon, coliform bacteria, sodium, and potassium. These substances are usually attenuated before they can impact the ground water. However, increases in chloride and nitrate-nitrogen were evident in ground water in some of the monitoring wells during the study. Chloride concentrations increased five-fold or more in some wells directly affected by spray irrigation, and nitrate-nitrogen concentrations increased eight-fold or more. Ground-water levels in the area of the spray field fluctuated over a range of several feet. These fluctuations were affected somewhat by spray irrigation, but the primary control on water levels was rainfall. As of December 1982, constituents introduced to the system by spray irrigation of effluent had not exceeded drinking water standard in the ground water. However, the system had not yet stabilized and more changes in ground-water quality could be expected. (USGS)
W86-02929

RECONNAISSANCE OF WATER QUALITY AT A U.S. DEPARTMENT OF ENERGY SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
M. Fernandez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4062, 1985. 49 p, 10 fig, 7 tab, 44 ref.

Descriptors: Water pollution control, Water quality, *Water pollution sources, Environmental quality, Ponds, *Spray irrigation, *Waste disposal ponds, *Florida, Pinellas County.

Sanitary and industrial wastes at the Pinellas Plant of the U.S. Department of Energy, prior to December 1982, were combined, treated, and disposed of by ponding and spray irrigation on a 10-acre tract within the plant site. Prior to 1972, the treated wastes were released to surface drainage features. An electromagnetic survey for ground conductivity was made to identify changes in the ground conductivity that may be due to the spray irrigation disposal operations. Water samples from four test wells drilled into the surficial aquifer and the two disposal ponds and bottom material from the ponds were analyzed for priority and nonpriority pollutants, total organic carbon, volatile organic carbon, herbicides, insecticides, trace metals, nutrients, and major constituents. Overall, concentrations of constituents in the water samples were (1) less than the detection limits, (2) within U.S. Environmental Protection Agency quality criteria for water, or (3) within the range of results for a designated background water-quality site. Concentrations of 12 priority pollutants were found to be considerably above detection limits. Concentrations of these compounds, mostly coal-tar derivatives, ranged from 220 to 5,500 micrograms per kilogram; the detection limit for these compounds is 10 micrograms per kilogram. Included in these compounds were anthracene, pyrenes, and chrysene. (USGS)
W86-02930

STREAMFLOW AND WATER QUALITY OF ONION RIVER, WISCONSIN--AN ASSESSMENT OF NONPOINT-SOURCE DISCHARGES,
Geological Survey, Madison, WI. Water Resources Div.
S. J. Field, and R. A. Lidwin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resouces Investigations Report 84-4066, 1984. 78 p, 12 fig, 6 tab, 31 ref.

Descriptors: *Small watersheds, *Water quality, Hydrology, *Wisconsin, Water temperature, Dissolved solids, Sediment yield, Onion River, *Nonpoint-source discharge, Suspended-sediment yield, Total nitrogen load, Total phosphorus laod.

The Onion River in eastern Wisconsin was monitored during the 1979 and 1980 water years to define the relationship between water quality, streamflow, and nonpoint-source discharges. Nonpoint-source discharges in the lower part of the Onion River are suspected of contributing significantly to degradation of water quality. Two streamflow water-quality monitoring stations were established on the Onion River, one at Hingham upstream of the affected area, and one near Sheboygan Falls downstream of the affected area. The 1979 streamflow was 60 percent greater than average, whereas the 1980 streamflow was about 5 percent less than average. Suspended-sediment yields and, probably, phosphorus yields were slightly above average for both years because of greater than normal precipitation, and because stream discharges were greater than normal in 1979 and near normal in 1980. A population of bottom-dwelling carp resuspends the bottom sediments during late spring and early summer, possibly causing high concentrations of suspended sediment and phosphorus during these periods. Suspended sediment and nutrient yields, and loading rates, were highest downstream of Hingham. Nonpoint-source contribution of phosphorus amounted to 362 pounds per square mile downstream of Hingham compared to 272 pounds per square mile upstream of Hingham in the 1979 water year. (USGS)
W86-02932

RECONNAISSANCE STUDY OF SALTWATER CONTAMINATION IN THE EL DORADO AQUIFER, UNION COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
M. E. Broom, T. F. Kraemer, and W. V. Bush.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4012, 1984. 47 p, 24 fig, 6 tab, 18 ref.

Descriptors: *Chlorides, *Aquifers, Geochemistry, Geohydrology, Geologic fractures, Water quality, *Arkansas, Union County, Sparta sand, Graben.

Since 1960 chloride concentrations in the El Dorado aquifer have increased near El Dorado, Arkansas. The aquifer is a major source for municipal and industrial water supply in Union County. Greatest withdrawal occurs near El Dorado. Because of this withdrawal, the potentiometric surface at El Dorado has been lowered more than 300 feet. Geologic, hydrologic, and chemical data indicate that water from a graben south and east of El Dorado is the source of contamination from salt within the El Dorado aquifer. The data indicates that surface brines and deeper aquifers are not the sources of chloride contamination. Lowering the potentiometric surface near El Dorado has caused water to move out of the graben toward El Dorado. Estimates based on interpretation of electric logs for two wells in the graben indicate chloride equivalents may be as high as 2,500 milligrams per liter in the aquifer. Concentrations outside the graben range from 130 to 650 milligrams per liter at the west end of the graben and from 25 to 150 milligrams per liter farther west and north. (USGS)
W86-02936

HISTORICAL WATER-QUALITY DATA FOR THE CLARK FORK (RIVER) AND THE MOUTHS OF SELECTED TRIBUTARIES, WESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
T. M. Brosten, and M. A. Jacobson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-168, 1985. 89 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Water quality, Sediment concentration, *Data collections, Trace metals, Sediment discharge, Clark Fork River, *Montana.

The Clark Fork, occupying a major drainage area in western Montana, leaves the state of Montana's largest river. This report is a compilation of recent historical water-quality data collected by the U.S. Geological Survey on the Clark Fork and near the mouths of major tributaries. Included in the report are water-quality data collected during various time intervals since 1969 at 18 surface-water stations. Because of the large amount of streamflow and water-temperature data collected at these 18 stations and at other sites in the study area, the data are not included in the report. However, station numbers and corresponding periods of record are listed and the availability of the data is identified. (USGS)

W86-02937

HYDROLOGIC BENCH-MARK PROGRAM AS A STANDARD TO COMPARE AND EVALUATE TIME-SERIES TRENDS IN SELECTED WATER-QUALITY CONSTITUENTS FOR STREAMS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02940

QUALITY OF IRRIGATION-RETURN FLOWS IN THE LOWER ARKANSAS RIVER VALLEY, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
D. Cain.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4273, 1985. 85 p, 20 fig, 19 tab, 21 ref.

Descriptors: *Return flow, Nutrients, Bacteria, *Water quality, Tailwater, Water budget, Salt budget, *Colorado, *Arkansas River.

Irrigation-return flows in the lower Arkansas River valley of Colorado were investigated using one-time data at 59 sites, monthly data at 4 sites, and intensive data in a small irrigated area. Specific conductance of return flows increased downstream, paralleling specific conductance of irrigation water. During July 1977, Arkansas River streamflow below Manzanola was mostly irrigation-return flow. A similar situation existed during periods of little precipitation in the early and late irrigation seasons during 1974 to 1978. Irrigation-return flows had a large effect on Arkansas River water quality during these times. (USGS)
W86-02942

PRELIMINARY APPRAISAL OF THE HYDROLOGY OF THE RED OAK AREA, LATIMER COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
M. V. Marcher, D. L. Bergman, J. D. Stoner, and S. P. Blumer.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4116, 1983. 44 p, 13 fig, 17 tab, 15 ref.

Descriptors: Strip mines, *Strip mine wastes, *Mine drainage, *Water pollution sources, *Coal mines, Water quality, *Oklahoma, Latimer County, Red Oak, Brazil Creek, Rock Creek.

In the Red Oak area, Oklahoma, water in shale bedrock occurs in bedding planes and fractures and is confined. Wells probably yield less than 5 gallons per minute. Ground water is a sodium or mixed cation carbonate/bicarbonate type with dissolved-solids concentrations ranging from about 300 to 700 milligrams per liter. No relationship between water chemistry and well depth or location is apparent. Brazil Creek flows 1 cubic foot per second or less about 25 percent of the time and has no flow about 15 percent of the time. Water in Brazil Creek is a mixed cation carbonate/bicarbonate type. Dissolved-solids concentrations upstream from old and recent mines ranged from 30 to 100 milligrams per liter whereas concentrations downstreams from the mines ranged from 50 to 600 milligrams per liter. Excessive levels of cadmium, chromium, lead, and mercury at times preclude use of water from Brazil and Rock Creeks for public supply. Maximum suspended-sediment discharge, in tons per day, was 2,500 for Brazil Creek and 3,300 for Rock Creek. Silt-clay particles with diameters less than 0.062 millimeter were the dominant sediment size. (USGS)
W86-02951

DISTRIBUTION AND SOURCE OF BARIUM IN GROUND WATER, CATTARAUGUS INDIAN RESERVATION, SOUTHWESTERN NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02955

PRELIMINARY EVALUATION OF HYDROLOGY AND WATER QUALITY IN RELATION TO THE TACOMA LANDFILL, PIERCE COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, and G. L. Turney.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4351, 1985. 35 p, 3 fig, 8 tab, 21 ref.

Descriptors: Water quality, *Groundwater pollution, Aquifers, Land use, *Landfills, Domestic water, Municipal water, Pierce County, *Washington, Tacoma landfill, *Groundwater quality, Surface water quality, *Hazardous wastes, Domestic water supplies, Municipal water supplies.

The Tacoma landfill, located in western Pierce County, Washington, has been used for the disposal of waste since about 1960. Disposal operations are planned to continue at this site until at least 1990. Data were compiled and interpreted to help understand the possible effects of the landfill on water quality in the surrounding area. Data were collected from published and unpublished reports of the U.S. Geological Survey, and from predominantly unpublished data in the files of other government agencies. The Tacoma landfill is underlain by unconsolidated, glacially derived deposits that consist of a wide variety of mixtures of clay to boulder-sized materials. Ground water is mostly the result of rainfall on the land surface, and moves through artesian aquifers (under the landfill) that are tapped for both domestic and municipal use. Hazardous liquid and dissolved wastes are probably present in the landfill, and potential flow paths for waste migration exist. An undetermined number of single-family domestic wells and 18 public-supply wells are within 3 miles of the landfill, three as close as 0.2 miles. There is only limited evidence indicating ground- and surface-water contamination. Further investigations of the geology, hydrology and water quality are needed to characterize the impact the landfill has on ground- and surface-water of the surrounding area. (USGS)
W86-02961

SELECTED TRACE-ELEMENT DATA FOR STREAMS IN THE SOUTHERN YAMPA RIVER BASIN, NORTHWESTERN, CO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. S. Maura.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-192, 1985, 154 p, 1 fig, 5 tab, 3 ref.

Descriptors: *Water quality, Data collections, Surface water, Water sampling, *Trace elements, Coal mining, Yampa River, *Colorado, Routt County, Moffat County.

Increases in coal mining in northwestern Colorado have increased concerns about the impact of mining on the chemical quality of surface water. One area of particular concern is in the southern part of the Yampa River basin. To identify the possible changes in water quality produced by mining in this area, it is first necessary to determine the present water chemistry resulting from the geology, climate, and land use. Because few data were available, a program for the synoptic collection of water-quality data was developed in which sampling sites were selected to determine the surface-water chemistry. (USGS)
W86-02967

CONCEPTUAL HYDROLOGIC MODEL OF FLOW IN THE UNSATURATED ZONE, YUCCA MOUNTAIN, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
P. Montazer, and W. E. Wilson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4345, 1984. 55 p, 14 fig, 1 tab, 37 ref.

Descriptors: *Hydrogeology, *Model studies, *Path of pollutants, Unsaturated zone, Fracture permeability, Infiltration, Percolation, Perched groundwater, Porous media, *Radioactive waste disposal, Aquifers, Yucca Mountain, Nevada Test Site, *Nevada Desert hydrology.

The unsaturated volcanic tuffs beneath Yucca Mountain, Nevada, are being evaluated as a host rock for a potential repository for high-level radioactive waste. A conceptual hydrologic model is proposed to describe the flow of fluids through these rocks. Thickness of the unsaturated zone is about 500 to 750 meters and consists of three welded units interlayered with two nonwelded units. Compared to nonwelded units, welded units have low matrix porosities and permeabilities, high fracture densities, and high bulk hydraulic conductivities. The principal repository area is bounded by normal fault zones. Of the average annual precipitation of 150 millimeters per year, 0.5 to 4.5 millimeters per year becomes net infiltration. Percolation through the matrix of the welded units is principally vertical and is less than 1 millimeter per year. Percolation through nonwelded units occurs both vertically and laterally and has variable rates (0.1 to 100 millimeters per year). Fracture flow is predominant in the uppermost welded unit during intense pulses of infiltration, but is insignificant in the welded unit that forms the potential host rock. Lateral flow in the upper nonwelded unit, enhanced by existence of a capillary barrier, probably is the factor controlling the low fluxes in the host rock and relatively high fluxes in the structural features. (USGS)
W86-02974

WATER-QUALITY STUDY OF THE TIDAL POTOMAC RIVER AND ESTUARY - AN OVERVIEW,
Geological Survey, Reston, VA. Water Resources Div.
E. Callender, V. Carter, D. C. Hahl, K. Hitt, and B. I. Schultz.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $. USGS Water-Supply Paper 2233, 1984. 46 p, 48 fig, 1 tab, 2 ref.

Descriptors: *Estuaries, *Tidal rivers, Water quality, Aquatic plants, Nutrients, Phytoplankton, Sediment transport, Dissolved oxygen, Benthic invertebrates, Hydrodynamics, Sedimentation, Maryland, Virginia, *Potomac River, *Potomac River Estuary, District of Columbia, *Path of pollutants.

The U.S. Geological Survey began a 5-year interdisciplinary study of the tidal Potomac River and Estuary in October, 1977. Its objectives are: (1) to provide an understanding of physical, chemical, and biological processes; (2) to develop models to predict the movement and fate of nutrients and algae; to improve techniques for the study of tidal rivers and estuaries; and to aid water-quality decision making for the Potomac. The study is being conducted by scientists from many disciplines involved in 14 inter-related studies. They are addressing five major problem areas: nutrient enrichment, algal blooms, dissolved oxygen, sedimentation, and aquatic animal and plant resources. Preliminary results show that sewage treatment reduced organic carbon and phosphorus below that of the 1960's and 1970's and changed the form of dissolved nitrogen in the tidal river. Concentrations of chlorophyll a were less than those during the massive algal blooms of the 1960's. Dissolved oxygen concentrations fluctuate in response to changes in algal populations, but remain above the EPA limits during the summer low-flow period. Sedimentation rates have accelerated during the past 50-70 years due to urbanization and farming. Asian clams recently invaded the tidal river; submersed aquatic vegetation declined since the early 1900's but conditions may now favor its return. (USGS)
W86-02975

SIMULATED EFFECTS OF ANTICIPATED COAL MINING ON DISSOLVED SOLIDS IN SELECTED TRIBUTARIES OF THE YAMPA RIVER, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. S. Parker, and J. M. Norris.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4084, 1983. 65 p, 38 fig, 15 tab, 3 ref.

Descriptors: *Mine drainage, *Model studies, Water quality, Stream discharge, Streamflow, Water quality, *Colorado, *Yampa River basin, Routt and Moffat Counties.

Identifying cumulative effects of coal mining on dissolved solids downstream from multipe coal-mining operations is particularly important in western basins. The problem of identifying cumulative effects is evident in the Trout Creek drainage, a tributary to the Yampa River in northwestern Colorado, where a number of mines are active and mine expansions are planned. As an evaluation tool, a model was developed and calibrated for the Trout Creek drainage and a reach of the Yampa River main stem. This model uses a series of nodes on the stream network to sum water quantity and quality through the network. The model operates on a monthly basis and uses data from water years 1976 to 1981. Output is mean monthly discharge, dissolved-solids concentration, and dissolved-solids load. Observed data are needed to initiate the model and for model calibration. Some data were extrapolated from records of nearby streamflow-gaging stations. Some nodes within the stream network were for inputs from anticipated mining and were inactive during calibrations. After calibration, these nodes were used to input water discharge at a given dissolved-solids concentration to reflect various future mine configurations. (USGS)
W86-02982

POTENTIOMETRIC SURFACE AND WATER QUALITY IN THE PRINCIPAL AQUIFER, MISSISSIPPIAN PLATEAUS REGION KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02983

TRAVELTIME, LONGITUDINAL-DISPERSION, REAERATION, AND BASIN CHARACTERISTICS OF THE WHITE RIVER, COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02984

QUALITY OF GROUND WATER USED FOR PUBLIC SUPPLY IN FLORIDA, 1983-84,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02986

HAZARDOUS WASTE RESEARCH, PENSACOLA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Mattraw, and B. J. Franks.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-466, 1984. 193 p, 35 fig, 23 tab, 67 ref.

Descriptors: *Creosote, *Groundwater pollution, Organic compounds, Biodegradation, Sorbtion, Sorption, Phenols, *Florida, Pensacola, *Hazardous waste, Gas chromatography, Mass spectrometry, Pentachlorophenol.

In 1983, the U.S. Geological Survey, Office of Hazardous Waste Hydrology, selected the former American Creosote Works site near Pensacola, Florida as a national research demonstration area. Seventy-nine years (1902-81) of seepage from unlined discharge impoundments had released creosote, diesel fuel, and pentachlorophenol (since 1950) wastes into the ground-water system. A cluster of from 2 to 5 wells constructed at different depths at 9 sites yielded water which revealed contamination 600 feet downgradient and to a depth of 100 feet below land surface near the site. The best cross-sectional representation of the contaminant plume was obtained from samples collected and analyzed for oxidation-reduction sensitive inorganic chemical constituents. Energy dispersive x-ray fluorescence detected recently formed iron carbonate in soil samples from highly reducing ground-water zones. Approximately eighty specific organic contaminants were isolated from ground-water samples by gas-chromotography/mass spectrometry. Column studies indicate the dimethyl phenols are not sorbed or degraded by the sand-and-gravel aquifer materials. Five of nineteen individual phenolic and related compounds are biodegradable based on anaerobic digestor experiments with ACW site bacterial populations. The potential impacts in the nearby Pensacola Bay biotic community are being evaluated. (USGS)
W86-02989

PRIMARY PRODUCTIVITY IN THE POTOMAC TIDAL RIVER, MARYLAND, MAY 1980 TO AUGUST 1981,
Geological Survey, Reston, VA. Water Resources Div.
R. R. H. Cohen, and S. O. Pollock.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4255, 1983. 28 p, 7 fig, 7 tab, 13 ref.

Descriptors: *Phytoplankton, *Potomac River, *Maryland, *Primary productivity, *Algae, Algal growth, Oxygen, Light intensity, Photosynthesis, Depth-integrated primary productivity, Productivity-light relationships, Photosynthesis-light relationship.

Primary productivity by phytoplankton was measured on samples collected from the Potomac Tidal River, Maryland. The studies were performed monthly from May 1980 to September 1981. Additional studies were done once a week in August 1980, twice a week from August 4 to 8, 1980 and twice in September 1980. Depth-integrated samples were collected at five stations and incubated in boxes that were exposed to natural sunlight. The boxes were covered with neutral density filters transmitting 100, 65, 32, 16, and 6 percent surface light. River water was pumped continuously over the samples. The extinction of light in the water column by phytoplankton was measured when samples were collected. Experiments were performed to select a method for routine productivity analysis. No difference was found between productivity: (1) determined in situ and in boxes; (2) measured in 300 ml and (4) calculated from short term (4 hours) and long term (10-24 hours) incubations. There were higher productivity differences in samples that were rotated among different light intensities every 15 minutes (simulating mixing) than those remaining stationary. Respiration was significantly less in samples pumped through a hose from those collected using a depth-integrating sampler. Depth-integrated primary productivity was determined from the productivity data using an equation modified from one reported in the literature. Depth-integrated gross primary productivity was highest in August 1980 and 1981 and lowest in January 1980. (USGS)
W86-03000

GROUND-WATER DEVELOPMENT ALTERNATIVES IN THE CHIPUXET GROUND-WATER RESERVOIR, RHODE ISLAND,
Geological Survey, Providence, RI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03001

EFFECT OF EUSTATIC SEA-LEVEL CHANGES ON SALTWATER-FRESHWATER RELATIONS IN THE NORTHERN ATLANTIC COASTAL PLAIN,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03010

DISSOLVED-OXYGEN REGIME OF THE JORDAN RIVER, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. W. Stephens.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4056, 1984. 56 p, 24 fig, 10 tab, 34 ref.

Descriptors: *Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Reaeration, Photosynthetic oxygen, Wastewater treatment, Jordan River, *Utah, Water quality, *Water pollution sources.

Concentrations of dissolved oxygen in the Jordan River in Salt Lake County decrease considerably as the river flows northward. Mean concentrations of dissolved oxygen decreased from 8.1 milligrams per liter at the Jordan Narrows to 4.7 milligrams per liter at 500 North Street during April 1981 to September 1982. Coincident with the decrease, the biochemical-oxygen demand increased from 5 to 7 milligrams per liter. About 50 percent of the dissolved-oxygen concentrations and 90 percent of the 5-day biochemical-oxygen demand measured downstream from 1700 South Street exceeded the State intended-use standards. An estimated 6. million pounds of oxygen-demanding substances as measured by 5-day biochemical-oxygen demand were discharged to the Jordan River during 1981 from point sources downstream from 9000 South Street. Seven wastewater-treatment plants contributed 77 percent of this load, nonstorm base flows contributed 22 percent, and storm flows less than 1 percent. The Surplus Canal diversion at 2100 South Street removed about 70 percent of this load, and travel time of about 1 day also decreased the actual effects of the load on the river. Reaeration rates during September and October were quite high (average K2 at 20 degrees Celsius was about 12 per day) between the Jordan Narrows and 9000 South Street, but they decreased to 2.4 per day in the reach from 1330 South to 1800 North Streets. (USGS)
W86-03011

GEOCHEMICAL SURVEY TO DETERMINE WATER-QUALITY CHARACTERISTICS OF THE BIG SIOUX AQUIFER IN EASTERN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
N. F. Leibbrand.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4069, 1985. 54 p, 7 ill, 4 tab, 10 ref.

Descriptors: Water Quality, *Water Sampling, *Groundwater, Statistical Analysis, *Groundwater quality, *Groundwater pollution, Water pollution sources, *South Dakota, Big Sioux River.

A geochemical survey of the Big Sioux aquifer, South Dakota was under taken to: (1) Estimate the quality of the water in the aquifer, (2) determine if there are any water-quality problems in the aquifer, and (3) design a water-quality monitoring network to monitor changes in present and potential water-quality problems. For most agricultural uses, the water in the Big Sioux aquifer is of acceptable quality. However, in some locations, the ground water is either marginally acceptable or unfit for human use. The major water-quality problem is the high nitrate concentrations (geometric mean of 4 and up to 120 milligrams per liter as N) found in many domestic water supplies. The fact that samples taken from observation wells located by rooads away from houses and barnyards show lower concentrations of nitrate (geometric means of 0.4 and up to 22 milligrams per liter as N) indicates that the source of nitrate pollution is

probably localized and due to barnyard wastes. A monitoring network is proposed consisting of at least: (1) Three wells adjacent to domestic wells, (2) three wells about 1,000 feet away and down the potentiometric gradient from domestic wells, and (3) three wells at least 3,000 feet from any source of pollution. This monitoring network would provide information on changes in both localized nitrate pollution and other selected water-quality parameters. (USGS)
W86-03019

WATER QUALITY AND STREAMFLOW DATA FOR THE WEST FORK TRINITY RIVER IN FORT WORTH, TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
S. C. McCutcheon, H. E. Jobson, R. E. Rathbun, and W. Gibbons.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4330, 1985. 101 p, 25 fig, 26 tab, 32 ref.

Descriptors: *Water quality data, Stream pollution, *Model studies, Steady flow, *Oxygen balance, *Biochemical oxygen demand, Organic carbon, Nitrogen cycle, Phosphorus, Lagrangian models, *Texas, Trinity River.

Water-quality data were collected on a 13.6-mile reach of the West Fork Trinity River in Fort Worth, Texas to test a dynamic Lagrangian model. Flow was steady. Loads of dissolved constituents varied with time at the beginning of the study reach and in the reach, primarily because of photosynthesis. River quality was fairly good despite low dissolved oxygen measured in the headwaters and the significant sewage load from the tributaries. Diel and longitudinal trends were defined by sampling at fixed sites and by following dyed parcels of water. Nitrification, deoxygenation, reaeration, and photosynthesis affected the dissolved oxygen balance. Independent estimates of some of the rate coefficients were 0.1 to 0.2, 0.8, and 0 to 3.6, all per day, for deoxygenation, nitrification, and reaeration, respectively. (USGS)
W86-03020

WATER RESOURCES AND POTENTIAL HYDROLOGIC EFFECTS OF OIL-SHALE DEVELOPMENT IN THE SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03021

PRELIMINARY STUDY USING DIGITAL MODELING TECHNIQUES TO UNDERSTAND AND PREDICT THE TEMPERATURE REGIME IN A STREAM BELOW A MAJOR RESERVOIR--THE NORTH SANITIAM RIVER BELOW DETROIT DAM, OR,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 6G.
W86-03022

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1983 - NOVEMBER 30, 1984,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03023

ASSESSMENT OF A STEADY-STATE PROPANE-GAS TRACER METHOD FOR DETERMINING REAERATION COEFFICIENTS-CHENANGO RIVER,
Geological Survey, Reston, VA. Water Resources Div.
N. Yotsukura, D. A. Stedfast, and G. H. Jirka.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4368, 1984. 69 p, 12 fig, 7 tab, 23 ref.

Descriptors: *Reaeration, *Tracers, *Open channels, Steady flows, Air-water interface, Gas tracers, Wind speeds, Mass transfer, *New York, Chenango River.

A test was conducted in a meandering 9.6-km reach of the Chenango River, New York, to assess the feasibility of a two-dimensional steady-state propane-gas tracer method as a means of estimating in situ reaeration coefficients. It is concluded that the method, which combines an instantaneous release of dye tracer with a long duration release of propane gas tracer, is very feasible for determining gas-desorption coefficients and wind effects in a wide river. However, the method does not appear to be ready for immediate operational applications. (USGS)
W86-03033

CHEMICAL QUALITY OF THE SAW MILL RIVER, WESTCHESTER COUNTY, NEW YORK 1981-83,
Geological Survey, Albany, NY. Water Resources Div.
R. J. Rogers.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4225, 1984. 51 p, 9 fig, 18 tab, 39 ref.

Descriptors: *Bottom sediments, Water quality, Heavy metals, Rivers, Nutrients, Pesticides, Organic compounds, Contamination, *Urbanization, Westchester County, *New York, Saw Mill River, *Water pollution sources.

Surface waters, bottom sediments and coatings formed on artificial substrates (ceramic tiles) were analyzed to evaluate the chemical quality of the Saw Mill River, New York. Heavy metals, nutrients, and organic contaminants were studied. Dissolved orthophosphate concentrations were highest in the lower third of the river. Dissolved manganese was the only metal to exceed U.S. Environmental Protection Agency water-quality criteria. Arsenic, cadmium, copper, lead, and zinc concentrations were highest in waters from the lowest 4 river miles. Concentrations of copper, lead, and zinc in bottom sediments from the lowest 3 river miles were greater than in upstream sediments. Concentrations of nine heavy metals were higher on tiles emplaced below river mile 3 than on tiles upstream. Few organic compounds were detected in the water column; none persisted at all sites. Chlordane, DDD, DDE, DDT, dieldrin, and polychlorinated biphenyls (PCB's) were found in bottom sediments throughout the basin. PCB concentrations were highest in the lowest 6 river miles; the other organic compounds exhibited no spatial patterns. Polynuclear aromatic hydrocarbons were most abundant in bottom sediments from the lowest 2 river miles. Collectively the distribution of contaminants indicates that river quality deteriorates in the lower, more heavily urbanized reach. (USGS)
W86-03035

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF PRAIRIE DU CHIEN-JORDAN, AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03042

DETERMINING THE EFFECTIVENESS OF HIGHWAY DRAINAGE SYSTEMS IN PREVENTING SALT CONTAMINATION OF GROUND WATER,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W86-03044

WATER-QUALITY DATA FOR 34 SITES, APRIL AND JUNE, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
P. J. Pulliam.
Available from OFSS, USGS, ox 25425, Lakewood, CO 80225. USGS Open-File Report 85-165, 1985. 13 p, 2 fig, 6 tab, 6 ref.

Descriptors: *Fate of pollutants, *Groundwater pollution, *Nuclear wastes, *Radioactive waste disposal, Radioactive wastes, *Stream pollution, Waste disposal, Water quality data, Water sampling, *Oak Ridge, Oak Ridge Reservation, Y-12 Plant, Roane County, Anderson County, *Tennessee.

Water-quality data were collected at 34 sites in the vicinity of the Y-12 Plant, Oak Ridge, Tennessee, on April 12 and 13, 1984. Concentrations of dissolved major and trace constituents were determined; field determinations of specific conductance, pH temperature, alkalinity, and dissolved oxygen were made. Gross alpha and beta activity were determined for 10 of the 34 sites, and dissolved organic carbon and oil and grease concentrations were determined for 11 of the sites sampled on June 3, 1984. (USGS)
W86-03048

MEASUREMENT OF GROUND-WATER VELOCITY USING RHODAMINE WT DYE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03051

DATA COLLECTION FOR A TIME-OF-TRAVEL AND DISPERSION STUDY ON THE COOSA RIVER NEAR CHILDERSBURG, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03052

DATA FROM A SOLUTE TRANSPORT EXPERIMENT IN THE LEVIATHAN MINE DRAINAGE, ALPINE COUNTY, CALIFORNIA, OCTOBER 1982,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. R. Flint, K. E. Bencala, G. W. Zellweger, and D. P. Hammermeister.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-85, 1985. 17 p, 60 fig, 28 tab, 8 ref, 3 append.

Descriptors: *Solute transport, Experimental data, *Chlorides, *Sodium, *Sulfate, *Fluorides, Streams, *Acid mine drainage, Environmental tracers, *Path of pollutants, *Tracers, Alpine County, *California.

A twenty-four hour injection of chloride and sodium was made into Leviathan Creek, Alpine County, California to aid interpretation of the coupled interactions between physical transport processes and geochemical reactions. Leviathan Creek was chosen because it receives acid mine drainage from Leviathan Mine, an abandoned open-pit sulfur mine. Water samples were collected at 15 sites along a 4.39 kilometer reach and analyzed for chloride, sodium, sulfate and fluoride. Dissolved concentrations are presented in tabular format and time-series plots. Duplicate samples were analyzed by two laboratories: the Central Laboratory, Denver, Colorado and a research laboratory in Menlo Park, California. A tabular comparison of the analyses and plots of the differences between the two laboratories is presented. Hydrographs and instantaneous discharge measurements are included. (USGS)
W86-03055

SEASONAL PATTERNS OF ALKALINITY IN THE SAN FRANCISCO BAY, CALIFORNIA, ESTUARINE SYSTEM DURING 1980,
Geological Survey, Menlo Park, CA. Water Re-

sources Div.
L. E. Schemel.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-4102, 1984. 54 p, 33 fig, 28 tab, 32 ref.

Descriptors: *Alkalinity, Salinity, *Estuaries, Mixing, Seasonal variation, Water quality, Path of pollutants, *Water pollution sources, *San Francisco Bay, *California, Sacramento River, Sacramento-San Joaquin Delta.

Salinity and alkalinity were measured in the near-surface waters of San Francisco Bay estuarine system at two-week intervals during 1980. Results are presented in figures and as numerical values, and the analytical methods are detailed. The transport of alkalinity to the Bay from the delta during 1980 was 3.8 x 10 to Ohe 10th power equivalents; this estimate is based on the freshwater alkalinity concentrations predicted by the north San Francisco Bay salinity-alkalinity distributions. North San Francisco Bay distributions are primarily the result of conservative mixing of freshwater from the Delta with Pacific Ocean water. Nonlinear distributions are the consequence of alkalinity variations in the freshwater rather than the effects of in-estuary processes or sources. Seasonal inflow of agricultural waste water is a major cause of freshwater alkalinity variations. South San Francisco Bay salinity-alkalinity distributions show the effects of variations in Delta outflow rate, local streams, and municipal waste-water inflows. (USGS)
W86-03059

SALINITY, ALKALINITY, AND DISSOLVED AND PARTICULATE ORGANIC CARBON IN THE SACRAMENTO RIVER WATER AT RIO VISTA, CALIFORNIA, AND AT OTHER LOCATIONS IN THE SACRAMENTO-SAN JOAQUIN DELTA, 1980,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. E. Schemel.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4059, 1984. 45 p, 14 fig, 7 tab, 39 ref.

Descriptors: *Alkalinity, *Organic carbon, *Salinity, River flow, Storm runoff, Return water, Seasonal variations, Path of pollutants, *Water pollution sources, *Estuaries, *San Francisco Bay, Water quality, *Sacramento River, San Joaquin River, Sacramento-San Joaquin Delta, *California.

Salinity, alkalinity, and dissolved and particulate organic carbon (DOC and POC respectively) concentrations in the Sacramento River water at Rio Vista were measured every three to five days during 1980 as part of an effort to identify time-dependent variations in the composition of the freshwater flow from the Sacramento-San Joaquin Delta to San Francisco Bay. Concentration ranges were generally small compared to the seasonal range of river flow rate; transport rates to the Delta and to the Bay varied primarily as a function of flow rate. Surface runoff from winter storms diluted salinity and alkalinity concentrations. DOC and POC were generally more concentrated during winter than during other times of the year. Variations in tributary flows resulted in sometimes-large salinity and alkalinity variations during spring through fall. Late summer concentrations were high because of large inflows of agricultural waste waters. POC and DOC concentrations were lowest during summer. (USGS)
W86-03063

CLASSIFICATION OF STREAM BASINS IN SOUTHEASTERN OHIO ACCORDING TO EXTENT OF SURFACE COAL MINING,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-03071

HYDROLOGIC DATA FOR LEVIATHAN MINE AND VICINITY, ALPINE COUNTY, CALIFORNIA, 1981-83,
Geological Survey, Carson City, NV. Water Resources Div.
D. P. Hammermeister, and S. J. Walmsley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-160, 1985. 161 p, 23 fig, 90 tab, 13 ref.

Descriptors: *Groundwater, Lysimeters, Piezometers, Sulfur, *Waste dumps, Bedrock, Biomass, Core drilling, *Mine wastes, *Water pollution sources, Bryant Creek, Leviathan Creek, Leviathan Mine, Countaineer Creek, Alpine County, *California, Sierra Nevada.

The U.S. Geological Survey collected basic hydrologic and water-quality data during 1981-83 to facilitate the geohydrologic evaluation of the Leviathan Mine area and the design of a pollution-abatement project. Surface-water field data included one or more measurements of pH, water temperature, and specific conductance at 45 sites in and adjacent to the mine area. At nine of these sites, daily data on discharge, specific conductance, and water temperature were collected during parts of 1981-82 by using electronic monitor-recorder systems. Ground-water field data included one or more of the water-quality measurements listed above at 71 piezometers in the mine area. Borehole geophysical data included neutron-moisture, neutron-porosity, gamma-gamma density, natural gamma, and temperature logs at three sites. Mineralogic and hydrologic data were obtained for cores taken from nine test holes. One or more surface-water samples from 26 sites were analyzed for major cations, major anions, and a wide range of minor inorganic constituents. Single ground-water samples from 36 piezometers were analyzed for the same array of major and minor constituents. (USGS)
W86-03091

RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS OF EASTERN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
D. J. Growitz, L. A. Reed, and M. M. Beard.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4274, 1985. 54 p, 6 fig, 38 tab, 23 ref.

Descriptors: *Mine drainage, Streamflow, *Acid mine discharge, Rainfall, Runoff, *Water pollution sources, *Coal mine wastes, Coal mine drainage, *Pennsylvania, Anthracite, Northern Field, Eastern Middle Field, Western Middle Field, Southern Field.

Anthracite has been extensively mined in four area of eastern Pennsylvania. Almost all underground mining in the Northern, Eastern Middle, Western Middle, and Southern Fields has been discontinued and many mines are abandoned and flooded. Precipitation on much of the 408 square miles of coal fields infiltrates to the underground mine complexes, and is discharged as mine drainage from tunnels, mine entrances, and boreholes. Mine drainage was measured and sampled at 251 sites, that had a total discharge of 918 cubic feet per second, and a total sulfate load of 1,470 tons per day. The largest sulfate yield was 5.4 tons per day per square mile from the Western Middle Field. Yields from the Northern, Eastern Middle, and Southern Fields were 4.6, 3.6, and 1.4 tons per day per square mile, respectively. (USGS)
W86-03092

DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE HOUSATONIC RIVER AND ADJACENT AQUIFER, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
F. B. Gay, and M. H. Frimpter.
Available from Distribution Br, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2266, 1985. 26 p, 17 fig, 30 ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, *Path of pollutants, Bottom sediments, *Sediment distribution, *Sediment transport, Induced infiltration, Unconfined aquifers, Suspended sediments, Sorption, Groundwater movement, Water quality, Dissolved oxygen, Ammonia, Iron, Manganese, Water temperature, *Stratified-drift aquifers, *Housatonic River, Woods Pond, Berkshire County, *Massachusetts.

Polychlorinated biphenyls (PCBs) are sorbed to the fine-grained stream-bottom sediments along the Housatonic River from Pittsfield, Massachusetts, southward to the Massachusetts-Connecticut boundary. The highest PCB concentrations, up to 140,000 micrograms per kilogram, were found in samples of bottom material from a reach of the river between Pittsfield and Woods Pond Dam in Lee, Massachusetts. Sediments in Woods Pond Contain about 11,000 pounds of PCBs. The distribution of hydraulic-heads, water-temperatures, and concentrations of dissolved-oxygen, ammonia, nitrate, iron, and manganese in water from the aquifer show that industrial water-supply wells in a sand and gravel aquifer adjacent to Woods Pond have been inducing ground-water recharge through the PCB-contaminated bottom sediments of the pond for the last 25 years. These data indicate that, at the shore of the pond, the upper 40 feet of the aquifer contains water derived from induced infiltration. However, this induced recharge has not moved PCBs from the bottom sediments into a vertical section of the aquifer located 5 feet from the edge of Woods Pond. At the detection limits of the chemical analyses, no PCBs were found sorbed to the aquifer material or dissolved in the ground water at selected intervals throughout this vertical section. (USGS)
W86-03093

URBAN WATER-QUALITY DATA AND STATISTICAL SUMMARIES FOR SELECTED SITES IN THE SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
L. M. Pope, A. M. Diaz, and M. K. Butler.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. Kansas Department of Health and Environment Bulletin B2-49, 1983. 203 p, 1 fig, 19 tab, 17 ref.

Descriptors: *Urban hydrology, *Urban runoff, Urbanization, Water quality, Chemical analysis, Sediment concentration, Statistical analysis, Biological properties, Shunganunga Creek, Topeka, *Kansas, Monitoring systems, *Data collections.

In 1978, the U.S. Geological Survey, in cooperation with the Kansas Department of Health and Environment, began an investigation to evaluate the quantity and quality of storm runoff from a major urban area in Kansas. The area chosen for study was the Shunganunga Creek basin, a rapidly urbanizing area in Shawnee county that includes a large part of the City of Topeka. Urban water-quality data, collected from May 1979 to December 1981, and statistical summaries are presented for six streamflow sites in the Shunganunga Creek basin. Included are data for discrete water samples dry-weather flow, storm runoff, snowmelt runoff, and data for composite samples of storm runoff. The statistical summaries include mean, minimum and maximum observed values, and standard deviation. These data may be of interest to Federal, State, and local agencies, or management councils that need information on general water quality, constituent concentrations, pollutants, and hydrographic distributions during storm-runoff periods from a major urban area in a sub-humid, central-plains environment. (USGS)
W86-03099

MAY 1984-APRIL 1985 WATER BUDGET OF REELFOOT LAKE WITH ESTIMATES OF SEDIMENT INFLOW AND CONCENTRATIONS OF PESTICIDES IN BOTTOM MATERIAL IN TRIBUTARY STREAMS--BASIC DATA REPORT,
Geological Survey, Nashville, TN. Water Re-

sources Div.
C. H. Robbins, J. W. Garrett, and D. M. Mulderink.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-498, 1985. 37 p, 31 fig, 14 tab, 2 ref.

Descriptors: *Lake levels, *Streamflow, Precipitation, *Sediment load, Suspended sediment, *Pesticides, *Water budget, Lakes, *Tennessee, Reelfoot Lake, Hydrologic data.

This report contains hydrologic data collected at Reelfoot Lake, Tennessee from May 1, 1984, through April 30, 1985. Continuous streamflow data were collected at four sites on the three major tributaries to Reelfoot Lake and at one site on the lake outflow channel. Daily rainfall and lake-stage were each collected at two sites on the lake shore. Additionally, suspended-sediment samples were collected by automatic samplers and also manually during equipment maintenance visits at three of the four tributary inflow sites. At these three inflow sites, samples of stream-bottom material were collected at low flow once during the study period and were analyzed to determine the concentration of various pesticides. Periodic observations of ground-water levels were made at 30 wells in the Reelfoot Lake basin. Monitoring sites and types of data collected at each site are listed. (USGS)
W86-03100

SELECTED HYDROLOGIC DATA FOR THE POWELL RIVER BASIN IN WISE COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
J. D. Larson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-186. 22 p, 14 fig, 4 tab, 63 ref.

Descriptors: *Water quality, Groundwater, Surface water, Water supply, *Coal mining, *Virginia, Wise County, Powell River basin.

Evaluation of selected surface-water, groundwater, and water-quality data shows that hydrologic data collected by governmental agencies comprises less than 10 percent of the total data available in the Powell River basin, Virginia. Only a small portion of the hydrologic data for the basin has been compiled and stored by Federal and state agencies in two computerized hydrologic indexing systems (National Water Data Exchange and Commonwealth Data Base). Selected ground-water, surface-water, and water-quality data collected in the Powell River Basin in Wise County, Virginia are summarized. The data are obtained from three coal-mining companies, the Virginia State Water Control Board, and the U.S. Geological Survey. Water-quality data for 61 ground-water and 86 surface-water sites indicate elevated iron and manganese concentrations are present throughout the basin. A bibliography of available hydrologic reports on the area and selected pertinent hydrologic reports from other coal-producing areas is present. (USGS)
W86-03103

TRAVELTIME AND DISPERSION IN THE POTOMAC RIVER, CUMBERLAND, MARYLAND, TO WASHINGTON, D.C.,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03123

ATMOSPHERIC DEPOSITION OF SELECTED CHEMICALS AND THEIR EFFECT ON NONPOINT-SOURCE POLLUTION IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
R. G. Brown.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4195, 1984. 24 p, 10 fig, 3 tab, 21 ref.

Descriptors: *Fallout, Runoff, *Water quality, *Nonpoint pollution sources, *Acid rain, *Twin Cities metropolitan area, *Minnesota.

Atmospheric inputs and runoff concentrations of total Kjeldahl nitrogen, dissolved nitrite-plus-nitrate nitrogen, total phosphorus, total sulfate (only for atmospheric input), total chloride, and total lead were studied from April 1 to October 31, 1980, in one rural and three urban watersheds in the Twin Cities metropolitan area, Minnesota. Seasonal patterns of wetfall and dryfall generally were similar for all constituents except chloride in both rural and urban watersheds. Similarity between constituents and between rural and urban watersheds suggested that regional air masses transported from the Gulf of Mexico by frontal storm movements influence seasonal patterns of atmospheric input in the metropolitan area. Local influences such as industrial, agricultural, and vehicular air pollutants were found to influence the magnitude or rate of atmospheric input rather than the seasonal pattern. Chloride was primarily influenced by northwest frontal storms laden with coastal chloride. Local influences such as dust from road de-icing salt are thought to have caused an increase in atmospheric chloride during June. The atmospheric contribution to nonpoint-source-runoff pollution of nitrogen, in the form of nitrite-plus-nitrate, and lead was extremely high, constituting as much as 84 percent of the runoff load. In contrast, phosphorus and chloride inputs were low, averaging 6 percent of the total runoff load. (USGS)
W86-03125

TOXIC SUBSTANCES IN SURFACE WATERS OF THE B. EVERETT JORDAN LAKE WATERSHED.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
Water Quality Section Report No 85-02, March 1985. 113 p, 32 fig, 22 tab, 36 ref.

Descriptors: Watershed management, *Urban runoff, Drinking water, *Toxicants, Water resources planning, Organic compounds, Heavy metals, *Toxic wastes, *Water pollution sources, *North Carolina, Piedmont reservoir.

A comprehensive review was made of possible sources of toxicants in the watershed (1628 sq. mi) of a newly formed reservoir (14,300 acre) in North Carolina in order to help state officials decide whether it was a suitable drinking water source. Point and nonpoint sources were analyzed including agriculture, urban areas, abandoned mines, landfills and industrial and municipal wastewater treatment plants. Point and nonpoint heavy metal sources were compared. Basin water quality was also assessed. In general, watershed rivers and streams showed reduced metal levels since 1980 reflecting improved WWTP's in the basins. Effluent toxicity was uncommon. Urban runoff contributes more metals than point sources. A large portion of this appears to be controllable with detention basins. Organic chemical analyses of the lake water did not detect any contaminants. Detailed recommendations for improved government monitoring of effluents, stream water quality and aquatic communities (macrobenthos) were made. Letters were sent to dischargers to collect full disclosure of information on toxicants. In summary, available water quality data did not identify any toxicants in the lake which would limit its use as a water supply. However, uncertainty still remains with respect to toxicants since the lake lies within a developed watershed. This report is the first in a series of comprehensive reviews of existing surface drinking water sources to more accurately focus state efforts to protect these water supplies.
W86-03132

COASTAL DEVELOPMENT AND SHELLFISH WATERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
Water Quality Section Report No. 85-05, April 1985. 38 p, 13 tab, 55 ref.

Descriptors: Coasts, Urban runoff, Microorganisms, Shellfish, Septic tanks, *Water pollution sources, Marinas, *North Carolina, Coastal development.

Collected stormwater runoff from medium and high density development in North Carolina contains indicator bacteria and pathogens, as well as a number of toxic pollutants. Several studies have demonstrated that is this runoff is collected and discharged into estuarine waters, standards for shellfish waters will be violated. New development practices are necessary in areas adjacent to estuarine waters if these waters are to remain open for shellfishing. Available information indicates that the construction and operation of marinas can adversely affect water quality. Data collected by the Division of Health Services (Shellfish Sanitation Branch) demonstrate that large marinas contribute to the loss of the best intended use of SA waters--shellfish harvesting. Unless siting and operational practices now in effect are modified, continued pollution of coastal waters can be expected. While guidelines for marina operation which have the potential to reduce water quality impacts can be included as conditions in permits, field studies documenting the effectiveness of these restrictions are lacking. Water quality problems associated with on-site sewage systems result from systems located on poor sites or from systems where there is inadequate separation between drain fields and the ground water table. Viruses and bacteria are not readily adsorbed in sandy coastal soils, and therefore use of on-site sewage systems under these conditions in proximity to SA waters may not adequately protect shellfish resources. Management options are discussed.
W86-03133

TEMPORAL TRENDS IN THE ACIDITY OF PRECIPITATION AND SURFACE WATERS IN NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
N. E. Peters, R. A. Schroeder, and D. E. Troutman.
Available from Distr. Br., USGS, 604 So. Pickett St., Alexandria, VA 22304. USGS Water-Supply Paper 2188, 1981. 39 p, 12 fig, 9 tab, 50 ref.

Descriptors: *Acid streams, *Acid rain, *Chemistry of precipitation, *Hydrogen ion concentration, Statistical methods, Water chemistry, Water pollution sources, *Acid precipitation, *New York, *Temporal trends.

Statistical analysis of monthly bulk-precipitation data from a nine-station monitoring network indicate little change in pH from 1965-1978 within New York as a whole but suggests a decrease in the western part by approximately 0.2 pH units and a comparable increase in the eastern part (equivalent to an average annual hydrogen-ion change of 0.2 microequivalents per liter). An average annual increase in precipitation quantity since 1965 has resulted in an increased acid load in the western and central parts of the state. During the same period, sulfate concentration decreased an average of 1-4 percent annually and no trend was detected for nitrate. Calculated trends in hydrogen ion do not correlate with trends in sulfate and nitrate. Neutralization, possibly by particles from dry deposition in the bulk samples, has produced an increase of about 0.3 pH units in nonurban areas and 0.7 pH units in urban areas over wetfall concentrations in reported other studies. Sulfate concentrations in streams throughout the state decreased an average of 1 to 4 percent per year, which is comparable to the decrease noted in precipitation. In most areas of the state, chemical contributions from urbanization and farming, as well as the neuralizing effect of carbonate soils, conceal whatever effects acid precipitation may have on pH of streams. (USGS)
W86-03135

EFFECTS ON WATER QUALITY OF COAL MINING IN THE BASIN OF THE NORTH FORK KENTUCKY RIVER, EASTERN KENTUCKY,

Geological Survey, Louisville, KY. Water Resources Div.
K. L. Dyer.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 81-215, 1983. 94 p, 6 fig, 9 tab, 93 ref.

Descriptors: Coal mines, Strip mines, *Mine drainage, *Strip mine wastes, *Mine acid, Acid streams, Water pollution sources, Neutralization, Pyrite, Acid rain, *Sediment yield, *Kentucky.

A study of the effects on water quality of coal mining in the basin of the North Fork Kentucky River shows increases in the mean annual total dissolved solids concentrations from about 8 to 50 milligrams per liter. It shows that the Hazard Number 9 coal seam produces the largest quantities of acid and sulfate. The study also shows that most of the acid mine drainage is neutralized by carbonate minerals or is replaced by exchangeable bases from the aquifer materials before it reaches the streams. The generation of sediment is probably the most damaging effect of strip mining on water quality in the basin. (USGS)
W86-03136

DISTRIBUTION AND OCCURRENCE OF TOTAL COLIFORM BACTERIA IN FLORIDAN AQUIFER WELLS, WESTERN LAKE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. F. Taylor.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4130, 1984. 28 p, 7 fig, 7 tab, 3 ref.

Descriptors: *Total coliform bacteria, *Floridan aquifer, Groundwater, Aquifer, *Florida, Western Lake County, Water quality, Water pollution sources.

Total coliform bacteria data for Floridan aquifer wells in western Lake County, central Florida, are presented. Included are data collected from 1966 to 1979 by the Florida Department of Environmental Regulation for 98 public-supply wells, and data collected during 1982 by the U.S. Geological Survey for 29 wells. The data for the 98 public supplies indicate that 85 percent have a record of total coliform occurrence in the raw water. Data from the 29 wells sampled by the Geological Survey indicate that 55 percent have a record total coliform occurrence. Further comparison of the two data sets indicates that the Geological Survey data generally indicate a lower percentage of sites with coliform occurrence and, in some cases, a different pattern of occurrence than did the Department of Environmental Regulation data. (USGS)
W86-03145

CHEMICAL AND BIOLOGICAL QUALITY OF STREAMS AT THE INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1978-80,
Geological Survey, Indianapolis, IN. Water Resources Div.
M. A. Hardy.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4208, 1984. 95 p, 27 fig, 18 tab, 39 ref.

Descriptors: Bacteria, Chlorinated hydrocarbons, Coliforms, DDD, DDE, DDT, Great Lake Region, *Indiana, Invertebrates, Land use, Macroinvertebrates, *National Lakeshores, Nutrients, Polychlorinated biphenyls, Sewers, Streams, Wastewater, *Water chemistry, Water quality, Wetlands, Indiana Dunes National Lakeshore, Periphyton.

Discharge from storm sewers and runoff from roads contributed lead, zinc, and chlorinated hydrocarbons (chlordane, DDT, DDD, DDE, and PCB's) to all streams except Derby ditch. In addition, the Little Calumet River received ammonia from industrial discharges, and organic materials, nitrogen, phosphorus, and fecal coliform from wastewater-treatment plant and sewer discharges. As a result, water at some sites in the lower reaches of the Little Camulet River contained dissolved ammonium nitrogen concentrations exceeding 0.10 mg/L (milligrams per liter), dissolved-oxygen concentrations less than 3.0 mg/L and fecal coliform populations exceeding 2,000 colonies per 100 milliliters. Seepage from two landfills may have caused the concentration of dissolved solids in the west Grand Calumet River lagoon to exceed that in the east lagoon. Ammonium concentrations in the west lagoon ranged from 13 to 16 mg/L as nitrogen. Pesticides used in agricultural areas were the major source of DDT, DDD, DDE, and dieldrin on streambed materials. Runoff from residential areas was a major source of nitrate, organic materials, and chlordane in Derby ditch and Dunes Creek. Wetland drainage contributed significant amounts of organic materials to streams and, at times, increased concentrations of dissolved sulfate and iron. Dissolved iron concentrations correlated with dissolved-organic-carbon concentrations in yellow-brown water of Kintzele ditch and Derby ditch. (USGS)
W86-03163

PROCESSES OF ATMOSPHERIC DEPOSITION OF METALS AND ACIDS TO FORESTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. E. Lindberg, R. R. Turner, and G. M. Lovett.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-017442, Price codes: A02 in paper copy, A01 in microfiche. 1982. 13 p, 1 fig, 3 tab, 21 ref. RP1907-1.

Descriptors: *Acid rain, *Metals, *Forest watersheds, *Air pollution, *Path of pollutants, Acids, Hydrogen ion concentration, Cations, Lead, Cadmium, Manganese, Zinc, Forests, Rain, Leaves, Absorption, Fate of pollutants.

This study attempted to quantify the atmospheric deposition of the water-leachable fractions of trace metals to upper canopy foliage, determine the major mechanisms of deposition, and assess the interactions between deposited metals and acid rain for several forested areas of the Walker Branch, Camp Branch, Coweeta, and Cross Creek Watersheds. Atmospheric sources contributed significantly to the annual flux of metals and acids to the forest floor in Walker Branch Watershed, Tennessee; deposition supplied 14% Mn, approximately 40% Cd and Zn, and approximately 99% Pb to this flux. The measured water solubility of these metals in suspended and deposited particles showed that they may be readily dissolved following deposition; however, only Pb appeared to be absorbed directly at the leaf surface. Dry deposition constituted a major fraction of the total annual atmospheric input of Cd and Zn (approximately 20%), Pb, (approximately 55%), and Mn (approximately 90%). In southern forests, interactions between dry deposition and acid rain can result in concentrations of metals and hydrogen ions on leaves considerably higher than those in rain alone. In the subalpine forests of New England, cloud deposition can also contribute to increased ion concentrations on leaves. (Geiger-PTT)
W86-03236

NEW INSTRUMENTATION FOR AIRBORNE ACID-RAIN RESEARCH,
Brookhaven National Lab., Upton, NY. Environmental Chemistry Div.
For primary bibliographic entry see Field 7B.
W86-03242

PRESENCE OF PATHOGENIC MICROORGANISMS IN POWER PLANT COOLING WATERS: REPORT FOR OCTOBER 1, 1979, TO SEPTEMBER 30, 1981,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. L. Tyndall.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2980, Price codes: A02 in paper copy, A01 in microfiche. Publication No. 2060, ORNL/TM-8523, September 1982. 26 p, 13 tab, 30 ref.

Descriptors: *Cooling water, *Pathogens, *Power plants, Electric power plants, Bacteria, Bacterial analysis, Water analysis, Pathogenic bacteria.

Cooling waters of eleven nuclear power plants and associated control source waters were studied for the presence of Legionnaires' Disease Bacterium (LDB) and thermophilic free-living amoebae. Concentrations of LDB were determined microscopically by fluorescent antibody analysis, and infectious LDB was demonstrated by guinea pig inoculation. Presence of pathogenic Naegleria was demonstrated by mouse inoculations. In general, the artificially heated waters showed only a slight increase (i.e., < or=10-fold) in concentrations of LDB relative to source water. In a few cases, source waters had higher levels than heated waters. Infectious LDB was found in seven of eleven test waters and five of eleven source waters. A new species of Legionella was isolated from one of the test sites. Concentrations of LDB in source and test water correlated with the concentration of nitrite, sulfate, and total organic carbon. While all but one test site was positive for thermophilic free-living amoebae, only two test sites were positive for pathogenic Naegleria fowleri. Pathogenic Naegleria were not found in control source waters. Laboratory studies demonstrate that both Acanthamoeba and Naegleria species could support the growth of various Legionella species. (Author)
W86-03243

ACIDITY, NUTRIENTS, AND MINERALS IN ATMOSPHERIC PRECIPITATION OVER FLORIDA: DEPOSITION PATTERNS, MECHANISMS, AND ECOLOGICAL EFFECTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
P. L. Brezonik, C. D. Hendry, E. S. Edgerton, R. L. Schulze, and T. L. Crisman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-165837, Price codes: A08 in paper copy, A01 in microfiche. EPA-600/3-83-004, February 1983. 165 p, 48 fig, 30 tab, 141 ref, 2 append.

Descriptors: *Acidity, *Nutrients, *Minerals, *Precipitation, *Ecological effects, Fate of pollutants, Nitrogen, Phosphorus, Hydrogen ion concentration, Chlorophyll, Sulfur compounds, Nitrogen compounds, Acid rain, Deposition, Zooplankton, Benthos, Invertebrates, Phytoplankton.

Nitrogen deposition via bulk precipitation averaged 0.77 g/sq m-yr at 21 sampling sites within Florida during the period May 1978-April 1979. Comparable values for total P are 17-111 and 50 mg P/sq m-yr. Nutrient concentrations were higher in summer than in winter. Wet-only input accounted for most of the deposition of NH4 and NO3 but dryfall was more important for organic N and TP. Statewide deposition of N and P was below the loadings associated with eutrophication, but loadings exceeded mesotrphic criteria at a few agricultural sites. The acidity of Florida rainfall has increased markedly in the past 25 yr; annual average pH < 4.7 now occurs over the northern two-thirds of the state. Summer rain is about 0.2-0.3 pH units lower than winter rain; excess sulfate levels are higher at most sites during summer. H2SO4 accounts for about 70% of the acidity, and HNO3 accounts for the remainder. Local emissions of SO2 seem to control the acidity of Florida rainfall. The pH in softwater lakes; the major trend in phytoplankton was a replacement of bluegreen algae by green algae in acidic lakes. Slight trends were noted in zooplankton and benthic invertebrate populations along a pH gradient, but results indicate that acidic conditions as low as pH 4.6 do not have major impacts on community structure in Florida lakes. (Author)
W86-03246

ACID PRECIPITATION: A CRITIQUE OF PRESENT KNOWLEDGE AND PROPOSED ACTION,
Virginia Center for Coal and Energy Research, Blacksburg.

W. R. Hibbard.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-900303, Price codes: A03 in paper copy, A01 in microfiche. June 1, 1982. 33 p, 10 fig, 5 tab, 69 ref.

Descriptors: *Acid rain, *Sulfur, *Nitrogen, *Water pollution prevention, *Cost-benefit analysis, *Air pollution, Sulfur compounds, Nitrogen compounds, Cost analysis, Nonpoint pollution sources, Fate of pollutants, Water pollution effects, Ecological effects, Environmental effects, Coal gasification, Legislation.

Acid precipitation is damaging to the ecology and is present in many areas. Possible sources of acid precipitation have been identified, but their specific roles in the production of acid rain have not yet been clarified. There are many natural sources of N and S that may contribute to the formation of acid precipitation. Research is needed to determine the mechanism of acid transformation, transport and disposition so that the role of various sources can be evaluated and the most cost-effective counter measures can be chosen. The effects of actual acid precipitation on forests, vegetation, fish, lakes and ecology are not as bad as originally thought. The acidification does not seem to be changing very rapidly. Current legislation, focused on sulfur dioxide emission from coal burning utilities, will cost $2 to $6 billion/yr and will be paid for primarily by utility customers in 10 states. The benefits of this legislation are not certain. Experiences in The Netherlands and Japan have shown that controlling the sulfur dioxide emissions did not reduce the amount of acid precipitation. It is highly probable that local sources are a significant cause of acid precipitation, and these sources are not addressed by the legislation. Further legislation aimed only at coal burning and distant sources will be expensive and probably ineffective. Research results that identify the major sources of acid precipitation will allow the implementation of effective preventive remedies and the lowering of pollution control costs. (Geiger-PTT)
W86-03273

UNSATURATED FLOW MODELING OF A RETORTED OIL SHALE PILE,
Battelle Pacific Northwest Labs., Richland, WA.
F. W. Bond, M. D. Freshley, and G. W. Gee.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-002632, Price codes: A05 in paper copy, A01 in microfiche. PNL-4284, UC-91, October 1982. 81 p, 34 fig, 4 tab, 21 ref, 5 append. DE-AC06-76RLO 1830.

Descriptors: *Oil shales, *Oil recovery, *Path of pollutants, *Unsaturated flow, *Hydraulic models, Groundwater movement, Groundwater pollution, Permeability coefficient, Hydraulic properties, Fate of pollutants, Simulation analysis, Models, Retention time.

Spent shales, generated during the recovery of crude oil from oil shale, contain soluble salts and other constituents that may exceed permissible levels if they enter local surface and groundwater systems. This study demonstrates the use of the UNSAT1D model for assessing the potential threat to the environment by simulating water movement through spent shale piles. Infiltration, redistribution, and drainage in a spent shale pile were simulated with the UNSAT1D model for two test cases: an existing 35 m pile, and a transient pile growing at a rate of 10 m/yr for 5 yr. The first test case simulated three different layering scenarios with each one being run for 1 yr. The second test case simulated two different initial moisture contents in the pile with each simulation being run for 30 yr. Grand Junction and Rifle, Colorado climatological data were used to provide precipitation and potential evapotranspiration for a wet and dry year. Hydraulic properties on Paraho process spent shale, soil and clay were used as model input to describe water retention and hydraulic conductivity. Results demonstrated that the UNSAT1D model can adequately simulate flow in a spent shale pile for a variety of initial and boundary conditions, hydraulic properties, and pile configurations. These results provided a preliminary sensitivity analysis in which it was shown that the material hydraulic properties, material layering, and initial moisture content are the principal parameters influencing drainage from the base of a pile. (Geiger-PTT)
W86-03281

SELECTED HYDROLOGIC AND GEOCHEMICAL ISSUES IN SITE CHARACTERIZATION FOR NUCLEAR WASTE DISPOSAL: FLOOD BASALTS AT THE HANFORD RESERVATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 5E.
W86-03282

MATHEMATICAL SIMULATION OF SEDIMENT AND RADIONUCLIDE TRANSPORT IN ESTUARIES,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi, and D. S. Trent.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2423, Price codes: A04 in paper copy, A01 in microfiche. NUREG/CR-2423, PNL-4109, November 1981. 62 p, 41 fig, 5 tab, 14 ref.

Descriptors: *Mathematical models, *Sediment transport, *Radioactive wastes, *Estuaries, *Fate of pollutants, Models, Model studies, Nuclear powerplants, Fluvial sediments, Finite element method, Mathematical studies, Simulation analsis, Cesium, Heavy metals, Salinity.

The finite element model FLESCOT (Flow, Energy, Salinity, Sediment and Contaminant Transport Model) was synthesized to simulate radionuclide transport in estuaries and to obtain accurate radionuclide distributions which are affected by time variance, three-dimensional flow, temperature, salinity, and sediments. FLESCOT simulates sediment and a sediment-sorbed radionuclide for the total of three sediment-size fractions (or sediment types) of both cohesive and noncohesive sediments. It also calculates changes of estuarine bed conditions, and three-dimensional distributions of three bed sediment sizes and sediment-sorbed radionuclides within the bed. The model also simulates transport of heavy metals, pesticides, or toxic chemicals. FLESCOT can use large aspect ratios of computational cells needed in handling long estuarine study areas. The model was applied to the Hudson River estuary between Chelsea and the mouth of the river for four cases to predict radionuclide transport through simulation of tidally influenced three-dimensional flow, salinity, sediment and radionuclide (Cs137) movements with their interactions. Considering the complexity of estuarine flow-transport processes, the lack of detailed radionuclide release rates from the Indian Point Nuclear Powerplant to the Hudson River, and the small number of adjustable model parameters, agreement between predicted results and measured data was reasonable. Further testing of FLESCOT and coupling with one-dimensional transport models is recommended. (Geiger-PTT)
W86-03284

SIMULATION OF GROUNDWATER FLOW AND CONTAMINANT TRANSPORT USING THE DETERMINISTIC-PROBABILISTIC CONTAMINANT TRANSPORT (DPCT) MODEL,
CGS, Inc., Urbana, IL.
E. D. McKay, T. M. Johnson, and M. T. Reade.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2904, Price codes: A03 in paper copy, A01 in microfiche. CGS/8115C029, April 1982. SAND 82-7077. 49 p, 15 fig, 13 tab, 11 ref, 2 append. 68-2130.

Descriptors: *Groundwater movement, *Path of pollutants, *Fate of pollutants, *Simulation analysis, *Computer models, *Probabilistic process, Mathematical models, Computer programs, Model studies, Stochastic process, Mathematical studies, Ion exchange, Water pollution sources.

Ten example problems are presented that illustrate the use and specific features of the deterministic-probabilistic contaminant transport (DPCT) computer program. DPCT provides solutions to the mass balance equation, known as the dispersion-convection equation, which represents mathematically the physiochemical and nuclear processes that are involved in the subsurface groundwater transport of a contaminant. Because DPCT has a stochastic component for the treatment of dispersion, it is inherently stable and free of the numerical dispersion that can occur with most other codes. The ten examples presented include input/output data and explanations of both code utilization and significance to transport characteristics. The ten examples cover the following conditions: two-dimensional transport by advective groundwater flow; dispersion with low dispersivity values; dispersion with higher dispersivity values; dispersion with high dispersivity ratio; ion exchange with low selectivity coefficient; ion exchange with higher selectivity coefficient; radioactive decay of contaminants; multiple contaminant source locations with different release characteristic; two-dimensional transport in a system of multiple geologic units with different hydraulic properties; and combined constant head and no-flow boundary. (Geiger-PTT)
W86-03288

TRANSPORT, FATE AND EFFECTS OF ENERGY-RELATED POLLUTANTS: EVALUATION OF SURFACE AND GROUNDWATERS,
Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
G. R. Hendrey, H. C. Thode, and N. Gmur.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82016610, Price codes: A06 in paper copy, A01 in microfiche. Second progress report, September, 1981. BNL-51473, Vol 1. 114 p. 19 fig, 17 tab, 2 app, 18 ref. DE-AC02-76CH00016.

Descriptors: *Water quality, *Acidic water, Freshwater, Alkalinity, Conductivity, Hydrogen ion concentrations, Pollutants, Water pollution sources, Water pollution effects, Path of pollutants.

Sensitivity of U.S. streams to acidification was studied by collecting data on alkalinity and alkalinity trends. The paper contains data in (a) an appendix and (b) a long table. The acquisition of new water quality data for inclusion in the Acidification Chemistry Information Database in fiscal year 1981 is reported. Stations with 3 or more values of alkalinity < or = 100 microequivalents/liter and/or 3 or more values of pH < or = 5.5 are regarded as candidates for listing as sensitive to acidification. There are 3,684 stations meeting this criteria for alkalinity, constituting 9.33% of all stations in ACID. There are 2,103 stations meeting the pH criterion, some of which are included in the total for alkalinity, and vice versa. The table includes the following: (1) county FIPS codes, (2) station code and abbreviated name, (3) latitude, (4) longitude, (5) total observations at each station, (6) number of alkalinity values < or = 100 meq/liter, (7) average of alkalinity values < or = meq/liter, (8) number of pH observations < or = pH 5.5, (9) average of H+ concentrations below pH 5.5, reexpressed as pH, (10) number of conductivity values associated with the above pH and/or alkalinity measurements, and (11) average of these conductivity values.
W86-03306

EFFECTS OF WEATHER SYSTEMS, CURRENTS, AND COASTAL PROCESSES ON MAJOR OIL SPILLS AT SEA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
S. P. Murray.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-120221, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 343. In: Pollutant Transfer and Transport in the Sea, Vol II, CRC Press, Boca Raton, FL, 1982. Edited by Gunnar Kullenberg. pp 169-227, 35 fig, 2 tab, 82 ref. NR 388-002. N00014-75-C-0192.

Descriptors: *Oil spills, *Fate of pollutants, *Coastal waters, *Path of pollutants, *Oil slicks,

Weather, *Oil pollution, *Water currents, Ocean waves, Environmental effects, Water pollution effects, Microbial degradation, Models, Model studies, Evaporation, Emulsions, Turbulence, Surface tension, Sedimentation.

The effects of weather systems on the movement and dispersal of oil slicks on the ocean's surface are considered. Currents driven by wind systems are affected by the rotation of the earth, which causes them to veer to the right of the wind in the northern hemisphere and to the left of the wind in the southern hemisphere. Evidence is accumulating that energy is being transferred from surface waves directly into moving oil slicks, imparting to them a speed slightly greater than that of the wind-driven current entraining the oil slick. Tidal currents play an important role in the near-field region of an oil spill. Evaporation, emulsification, turbulence, surface tension effects, sedimentation, and microbial activity are active in dispersing or degrading the oil slick. In the Torrey Canyon spill off the west coast of England, large scale winds controlled oil movement, while in the Chevron Platform spill in the Gulf of Mexico, rapidly migrating high- and low-pressure systems were in effect. The Argo Merchant spill was largely controlled by oceanic processes while the Amoco Cadiz was a coastal spill controlled by littoral and esturine processes. The most effective models of oil spill movement still use empirical rules. The Galt's numerical diagnostic model allows for complex coastal boundaries and the incorporation of barcolinic pressure gradients. The model of Hess and Kerr solves the oil momentum equations directly for the thickness of the oil slick as well as the velocity of the oil in space and time. Suites of processes representative of certain areas considered critical on the basis of biological, recreational, or navigational factors should be modeled.
W86-03314

INFLUENCE OF HUMIC-ACID COMPLEXING ON THE MOBILITY OF AMERICIUM IN THE SOIL AQUATIC ENVIRONMENT,
Washington State Univ., Pullman. Dept. of Chemical Engineering.
J. C. Sheppard, M. J. Campbell, and J. A. Kittrick.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-013666, Price codes: A02 in paper copy, A01 in microfiche. DOE/EV/73012-2, March, 1982. 10 p, 1 tab, 4 ref.

Descriptors: *Americum, *Humic acids, Soil, Actinide, Environment, Diffusion coefficient, Radioactive tracers, *Path of pollutants, Soil water movement.

Diffusion data indicate the Am, Cm and Np migrate 1.2, 0.8 and 26 cm. respectively, in 1000 years. Measured diffusion coefficients, corrected for distribution between the aqueous and soil phases, tortuosity, negative absorption, and relative fluidity are in reasonable agreement with aqueous diffusion coefficients. Two sets of experiments with Am241 and Eu152 tracers measured distribution ratios as a function of the aqueous humic acid concentration. In the first experiments the solid phase was kaolinite and in the second series, distribution ratios were measured with Burbank sandy loam. Both of these experiments indicated that Am(III) and Eu(III) form very strong humic acid complexes with formation constants of approximately 100,000.
W86-03315

CHARACTERIZATION OF GLENWOOD SPRINGS AND DOTSERO SPRINGS WATERS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2K.
W86-03333

SOURCES, CHEMISTRY, FATE AND EFFECTS OF AMMONIA IN AQUATIC ENVIRONMENTS,
EA Engineering, Science, and Technology, Inc., Sparks, MD.
American Petroleum Institute, Washington, DC, 1981. 130 p, 4 fig, 21 tab, 115 ref.

Descriptors: *Ammonia, *Aquatic environment, Industrial wastes, Municipal wastes, Water quality Standards, Toxicity, Analytical techniques, Fate of pollutants, Aquatic fauna, Aquatic flora, Temperature effects, Hydrogen ion concentration, Salinity, Dissolved oxygen, Sublethal effects.

The relevant published and unpublished literature pertaining to the sources, chemistry, fate, toxicity, and detection of ammonia in surface waters is reviewed. Four basic ammonia analytical techniques currently available are compared in terms of chemical interferences, sensitivity ranges, analytical precision, and ease of determination. The chemistry of ammonia in aquatic systems is reviewed. The role of ammonia in the nitrogen cycle; the role of nitrification in ammonia losses; environmental factors affecting nitrification; the significance of nitrite buildup; assimilation by aquatic species; and other natural mechanisms of ammonia removal are all discussed. Published and unpublished data are used to evaluate the relative contribution of industrial point sources of ammonia to surface waters compared to publicly owned treatment works (POTWs). Natural and anthropogenic nonpoint sources are also discussed, although quantitative assessments cannot be as definitive as the industrial point sources. The acute, chronic, and sublethal effects of ammonia on vertebrate and invertebrate aquatic organisms are reviewed. Chemical and biological factors that have been shown to influence the toxicity of un-ionized ammonia are summarized including: temperature, pH, salinity, dissolved oxygen and carbon dioxide, acclimation to and recovery from sublethal exposures, species and life-stage differences, and the effect of chemical mixtures containing ammonia. The existing regulatory framework concerning the discharge of ammonia in industrial point-source effluents is considered with emphasis on how aquatic toxicity data is used by regulatory agencies in the derivation of water quality criteria and standards.
W86-03334

HEAVY METALS POLLUTION OF THE UPPER ARKANSAS RIVER, COLORADO, AND ITS EFFECTS ON THE DISTRIBUTION OF THE AQUATIC MACROFAUNA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. A. Roline, and J. R. Boehmke.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-81-15, September 1981. 71 p, 21 fig, 6 tab, 1 app, 173 ref.

Descriptors: *Heavy metals, *Water pollution, *Water pollution effects, *Aquatic life, *Water pollution sources, Chemical analysis, Water analysis, Water quality, Mine drainage, Environmental effects, Arkansas River, Colorado.

A limnology study was done on a 30 km section of the upper Arkansas River, Colorado, to determine the effects of heavy metals pollution on the distribution of the aquatic macrofauna. Physical and chemical water parameters were measured, aquatic macroinvertebrates were collected, and fish populations at selected stations were evaluated to determine density and heavy metal content of tissue. Historically, river flows which dilute heavy metal concentrations were not as high as those occurring since transmountain diversions began, so it is possible that heavy metal concentrations in the river were greater in the past. However, water quality, species diversity of aquatic macroinvertebrates, fish populations, and metal accumulation in fish tissue show that heavy metal pollution of the upper Arkansas River near Leadville, Colorado, is presently very severe. Conditions for aquatic life are generally poor even though physical parameters and major ion concentrations are adequate for the survival of most aquatic organisms. Heavy-metal-laden inflows adversely affect water quality and thus the aquatic animal populations, while freshening inflows improve water quality and, therefore, conditions for the aquatic fauna. The major sources of heavy-metal-laden inflows are the Leadville Drainage Tunnel, California Gulch, and a number of intermittent flows entering between Lake Fork and Lake Creek. Important freshening flows are Tennessee Creek, Lake Fork (containing Halfmoon Creek), and Lake Creek. It is highly probable that a substantial reduction or elimination of any of these freshening inflows will result in a degradation of water quality and adversely affect the aquatic organisms.
W86-03338

ENVIRONMENTAL PROTECTION: STANDARDS, COMPLIANCE AND COSTS,
Ellis Horwood Ltd, Chichester, England. 1984. Edited by T. J. Lack. Ellis Horwood Series: Water and Wastewater Technology. 329 p.

Descriptors: *Aquatic environment, *Environmental protection, *Water pollution control, *Great Britain, Europe, Toxicity, Water pollution effects, Legal aspects, Law of the sea, Water law.

This book presents an examination and critical appraisal of the scientific basis and operational approaches to pollution control. It provides an insight into the problems facing those charged with the responsibility of protecting the environment. The focus of the book is the criteria used in judging compliance with standards, the balance between cost and health hazard, and the priorities for pollution control measures in Great Britain. The importance of toxicological and epidemiological studies is stressed, and operational approaches are illustrated with case studies. The major topics covered are the nature and associated risks of water pollution, the assessment of the effects of pollution, protection and control, operational aspects, and environmental management. (Halterman-PTT)
W86-03344

ORIGINS AND PATHWAYS OF AQUATIC POLLUTANTS,
Department of the Environment, London (England).
N. J. King, P. R. Hinchcliffe, and J. L. Vosser.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd., Chichester, England, 1984. p 22-32, 5 tab, 3 ref.

Descriptors: *Aquatic environment, *Toxicity, *Water pollution effects, *Water pollution sources, Chemical wastes, Industrial wastes, Runoff, Agricultural runoff, Urban runoff, Farm wastes, Mine wastes, Oil pollution.

A complete understanding of the many facets of the protection of aquatic environments requires a basic knowledge of the origins and pathways of aquatic pollutants. This review discusses the routes, or pathways, by which substances which might cause significant and undesirable changes can reach the environment. The primary sources discussed are domestic sewage, manufacture and use of chemicals, toxic waste leachates, atmospheric fallout, run-off, accidental spills or explosions, mineral oil production, mining, farming, solubilization of solid substances due to changes in the chemistry of the surrounding environment, waste heat generation, and natural sources. Several pathways are discussed, with emphasis on direct discharges to inland surface waters. Several transformation processes are described which may affect the passage of materials into aquatic environments. These processes are photodegradation, hydrolysis, neutralization, precipitation, solubilization and chelation. (Halterman-PTT)
W86-03345

NATURE AND CONCENTRATION OF POLLUTANTS IN WATER,
Water Research Centre, Medmenham (England). Medmenham Lab.
M. Fielding, and D. T. E. Hunt.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 33-54 p, 2 fig, 9 tab, 55 ref.

Descriptors: *Aquatic environment, *Water pollution effects, *Water pollution sources, Chemical wastes, Industrial wastes, Acids, Bases, Trace metals, Nitrogen, Phosphate, Sulphur, Organic matter, Hydrocarbons.

This paper presents a review of chemical pollutants found in both marine and freshwater environments. The primary emphasis is the importance of pollution by each group of pollutants discussed; the standards, or regulations, concerning allowable concentrations in aquatic systems; and the ranges of concentrations at which these are generally observed. The pollutants that are included in the review are grouped as organic and inorganic. The inorganic materials are acids, alkalis, nitrate, ammonia, trace metals, trace metalloids, sulphur, cyanide and sulphite. The organic materials that are covered in this paper are 'total organic matter', hydrocarbons, halogenated compounds, carboxylic acids and esters, and oxygenated compounds such as ketones, aldehydes, and ethers. Several natural organic substances often found in waters are also discussed. These are amino acids, sugars, fatty acids, phenols, sterols, vitamins, ketones, aldehydes, hydrocarbons, urea, and uronic acids. Techniques for analyzing water samples for pollutants are also discussed. (Halterman-PTT)
W86-03346

ROLE AND ACTIVITIES OF THE OSLO AND PARIS COMMISSIONS,
F. Bjerre, and P. A. Hayward.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 142-157 p.

Descriptors: *Aquatic environment, *Environmental protection, *Toxicity, *Ocean dumping, Standards, Water quality standards, Monitoring, Specifications, Paris, France, Oslo, Norway.

To adequately protect the marine environment, international control is not only justified, but is thought by many, including the author of this paper, to be the only appropriate level at which action can be initiated. Therefore, for the protection from pollution of the North East Atlantic region, the Oslo and Paris Commissions were established by international treaty. The Oslo Convention dealt with the issue of ocean dumping by European countries. A list of substances which are prohibited for dumping was generated. Furthermore, several regulations governing dumping procedures, such as distance from land and depth of water, were outlined. The Paris Convention dealt with controlling ocean pollution from European land-based sources. These sources include discharges through rivers, estuaries, outfalls and pipelines and national jurisdiction. A major problem faced by the two commissions in the ten years since their negotiation is the differing environmental problems and policies of the various participating European countries. The commissions decided that a better understanding of these different circumstances is necessary, and therefore, they set aside specific times for participating countries to make presentations describing national policies. (Halterman-PTT)
W86-03352

FATE OF CHEMICALS IN THE ENVIRONMENT: COMPARTMENTAL AND MULTIMEDIA MODELS FOR PREDICTIONS,
American Chemical Society, Washington, DC.
ACS Symposium Series 225, American Chemical Society, Washington, DC, 1983. Edited by Robert L. Swann and Alan Eschenroeder. 320 p.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Organic compounds, Water pollution sources, Pesticides, Mathematical models, Aquatic environment.

The latest modeling methods for predicting the effect and ultimate fate of chemicals released into the environment are presented. Single media models outline the actions of chemicals within an isolated segment of the environment. Aquatic, soil and groundwater, and airborne models are discussed, followed by multimedia models. The latter describe chemical interactions within a single compartment as well as between different media. The current situation in calibration, verification, and field testing of models is summarized. Uses of several models in practical applications are given. These include a series of polychlorobiphenyls, binding of humic and fulvic acids with organic chemicals, and fate of several herbicides in soil. The use of models in determining human and environmental risks is also illustrated. (Cassar-PTT)
W86-03362

RELEASE OF CHEMICALS INTO THE ENVIRONMENT,
SRI International, Menlo Park, CA.
S. L. Brown, and D. C. Bomberger.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Prediction, American Chemical Society, Washington, DC, 1983. p 3-21, 8 fig, 4 tab, 3 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Water pollutions sources.

Chemicals can be released directly or indirectly into water resources from natural processes and from human activity (during raw materials extraction, manufacture or processing, accidents, storage and transportation, use, and after disposal. Chemicals may be released in solid, liquid, or gaseous form from a variety of sources: point (smoke stack), line (highway transport), area (group of homes), and volume (smog). Time patterns of release can be continuous, intermittent, cyclic, random, or concentrated. Techniques for estimating release are reviewed. One method measures the amount of substance released, as in a pesticide application. Another uses material balance. Mathematical models and ad-hoc methods are also useful. Benzene is used as a case study to illustrate the ad-hoc approach. (Cassar-PTT)
W86-03363

FATE OF CHEMICALS IN AQUATIC SYSTEMS: PROCESS MODELS AND COMPUTER CODES,
Environmental Research Lab., Athens, GA.
L. A. Burns.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. p 25-40, 1 fig, 56 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Computers, Chemical reactions, Aquatic environment, Pesticides, Mass transfer, Ionization, Sorption, Volatility, Bioaccumulation, Accumulation, Photolysis, Hydrolysis, Oxidation, Microbiological studies, EXAM models, HSPF model, PEST model, SERATRA model, TOXIC model, UTM-TOX model, WASP model.

Aquatic fate models are designed to forecast the residual concentrations, dominant transformation pathways, distributions among subsystems, and characteristic time scales of xenobiotic chemicals. Most are constructed as systems of differential equations organized around mass balances. The resulting computer codes are used as aids in chemical use and disposal evaluations; their primary function is to reduce complex chemical and environmental data sets to useful forms. Relevant chemical phenomena include direct and indirect photochemical reactions, hydrolytic processes, biotransformations, ionic speciation, and sorption. These phenomena include both reversible and irreversible processes, with a mixture of time scales ranging from the virtually instantaneous to the imperceptible, depending on the structure and reactivity of the chemical involved. Aquatic transport processes include hydrodynamic transport of chemicals sorbed with particulates, volatilization, and exchange across the benthic boundary layer. The models combine chemical partitioning and rate constants with environamental driving forces, yielding a set of differential equations that can be analyzed to reveal chemical behavior as a function of time, space, and extrinsic chemical loadings. (Authors)
W86-03364

SOIL AND GROUNDWATER FATE MODELING,
Little (Arthur D.), Inc., Cambridge, MA.
M. Bonazountas.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. p 41-65, 2 fig, 4 tab, 37 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, *Soil, Groundwater, Aeration zone, Saturated zone, Mathematical models, Equilibrium, Water pollution sources, Land disposal, Landfills, Leachates, Industrial wastes, Agriculture, Sorption, Ion exchange, Chemical reactions, Ionization, Oxidation, Hydrolysis, Bioaccumulation, Accumulation, Chelation, PESTAN model, SCRAM model, SESOIL model, PATHS model, AT123D model, MMT model.

Soil compartment chemical fate modeling has been traditionally performed for three distinct subcompartments: the land surface (or watershed); the unsaturated soil (or soil) zone; and the saturated (or groundwater) zone of a region. In general, the mathematical simulation is structured around two major cycles; the hydrologic cycle and the pollutant cycle, each cycle being associated with a number of physicochemical processes. Watershed models account for a third cycle; sedimentation. This paper discusses: (1) soil and goundwater; and (2) aquatic equilibrium and ranking models. The second category deals with the chemical speciation in soil and groundwater, and with the environmental rating of waste sites, in cases where detailed modeling is notot desirable. Unsaturated soil zones models can simulate flow and quality conditions of a soil zone profile extending between the ground surface and the groundwater table. The traditional modeling employs either the time dependent diffusive convective mass transport differential equation in homogeneous isotropic soils, or simplified analytic expressions. Compartmental modeling is an area of current research. Equations are principally solved numerically or analytically when seeking exact solutions for simplified environments. Groundwater models describe the fate of pollutants in aquifers. Ironically enough, although the number of model types is large, only a few basic processes are modeled, mainly via the convective, dispersive, adsorptive, reactive, pollutant transport equation in a saturated porous medium, which is solved via analytical, numerical, or statistical techniques, and for one pollutant at a time. (Author)
W86-03365

ROLE OF MULTIMEDIA FATE MODELS IN CHEMICAL RISK ASSESSMENT,
Little (Arthur D.), Inc., Cambridge, MA.
A. Eschenroeder.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. p 89-104, 22 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, *Risks, Water pollution sources, Mathematical models.

This paper relates mathematical models for chemicals moving through air, water, soil, and biota to methodologies for assessing health risks to individuals or ecosystems experiencing environmental exposures. The procedures for assessing risks are traced from sources to receptors, and the application of models to this process is described. The paper sets out to answer questions of how to select and link models in the context of risk assessment. The theory, structure, verification, and application of the models themselves is left to other papers in this symposium. Acute risks are distinguished from chronic risks in the context of environmental regulatory requirements. A technique for selecting and assembling multimedia models based on release, environmental and receptor characteristics is described. (Author)
W86-03366

NEW MATHEMATICAL MODELING SYSTEM,
University of the Pacific, Stockton, CA. Dept. of Civil Engineering.
R. C. Johanson.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions,

American Chemical Society, Washington, DC, 1983. p 125-147, 12 fig, 13 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Mathematical models, Hydrological Simulation program, Adsorption, Sediments, Pesticides, Degradation, Computer models, Water quality.

The Hydrological Simulation Program - Fortran (HSPF) simulates the movement of water, sediment and many associated constituents over and under the land surface, and through streams, rivers and shallow lakes. It is a relatively new package, funded by the U.S. EPA. Substances such as pesticides are handled by simulating the processes of adsorption and desorption, transport in the dissolved and adsorbed states, and degradation through hydrolysis, photolysis, oxidation by free radicals, etc. Spatial variation is handled by subdividing the area into processing units, each of which represents a relatively homogeneous segment of pervious or impervious land-surface, or a reach of channel or an impoundment. HSPF operates on the basis of continuous simulation; the user can select a time step ranging from 1 minute to 1 day. The software package incorporates many modern features which have made it reliable and easy to install on a variety of machines. It is also easy to use and extend. (Author)
W86-03367

MODEL PREDICTIONS VS. FIELD OBSERVATIONS: THE MODEL VALIDATION/TESTING PROCESS,

Anderson-Nichols and Co., Inc., Palo Alto, CA.
A. S. Donigian.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. p 151-171, 3 fig, 2 tab, 14 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, *Field tests, Calibrations, Validation, Error analysis, Lakes, Sediments, Streams.

Model validation and field testing of chemical fate and transport models were discussed in several recent workshops, summarized in this paper. The terms calibration, verfication, and post-audit are clearly defined. Field validation and testing of models involves error analysis. The types of errors affecting the process are input errors (usually the most significant), system representation errors, parameter errors (derived from the inability to accurately measure and predict many parameters), and output errors (the most insidious). The possibility of these errors dictates that model results be considered with informed skepticism. The extent of field testing is listed for many modeled processes (dispersion-diffusion, advection, intermedia transfers, sediment/particulate transport, and transformation) used in the following media: air, runoff, streams, lakes, estuaries, soil unsaturated zone, and soil saturated zone. In general, screening level models have been more widely field tested than site-specific models. At present, unified and accepted procedures for model validation do not exist. However, most procedures fall into three categories: small-scale parameter estimation followed by field application, split-sample field testing, and site-to-site extrapolation of model results. In model performance testing three types of comparisons are often made: paired-data; time and space integrated, paired-data; and frequency domain. (Cassar-PTT)
W86-03368

PARTITION MODELS FOR EQUILIBRIUM DISTRIBUTION OF CHEMICALS IN ENVIRONMENTAL COMPARTMENTS,

Dow Chemical Co., Midland, MI.
P. J. McCall, R. L. Swann, and D. A. Laskowski.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 105-123 p, 3 fig, 4 tab, 29 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Equilibrium, Partition coefficients, Bioaccumulation, Accumulation, Aquatic environment.

Distribution of organic chemicals among environmental compartments can be defined in terms of simple equiolibrium expressions. Partition coefficients between water and air, water and soil, and water and biota can be combined to construct model environments which can provide a framework for preliminary evaluation of expected environmental behavior. This approach is particularly useful when little data is available since partition coefficients can be estimated with reasonable accuracy from correlations between properties. In addition to identifying those environmental compartments in which a chemical is likely to reside, which can aid in directing future research, these types of models can provide a base for more elaborate kinetic models. (Author)
W86-03369

APPLICATION OF FUGACITY MODELS TO THE ESTIMATION OF CHEMICAL DISTRIBUTION AND PERSISTENCE IN THE ENVIRONMENT,

Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay, S. Paterson, and M. Joy.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 175-196 p, 9 fig, 2 tab, 15 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Model studies, Fugacity models, Organic compounds, Polychlorinated biphenyls, Chlorobiphenylks, QWASI model, Quantitative Water Air Sediment Interaction model, Mathematical models, Lakes.

The roles of mathematical models for predicting the likely behavior of chemicals in real and evaluative environments are discussed, and it is suggested that more consideration should be given to defining acceptable levels of model complexity. The concepts underlying a series of fugacity models are described and illustrated by applying the models to (1) an assessment of the behavior of a trichlorobiphenyl with four fugacity models of an evaluative lake environment as an illustration of various levels of complexity, (2) an assessment of the relative behavior of mono-, di-, tri-, and tetrachorobiphenyls in the same environment as an illustration of the effect of changing chemical properties on behavior, and (3) a description of trichlorbiphenyl behavior in a lake similar to Lake Michigan using the QWASI (Quantitative Water Air Sediment Interaction) fugacity model. It is concluded that evaluative models can generate behavior profile information of value for hazard assessment purposes by integrating data on partitioning, reaction, advection, and interphase transport. By applying the same concepts and equations to models of real environments and validating them, the evaluative and real modeling efforts become mutally supportive and the credibility of both is increased. (Author)
W86-03370

INTERACTIONS BETWEEN DISSOLVED HUMIC AND FULVIC ACIDS AND POLLUTANTS IN AQUATIC ENVIRONMENTS,

Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
C. W. Carter, and I. H. Suffet.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 215-229 p, 6 fig, 2 tab, 24 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, *Organic carbon, Fulvic acids, Humic acids, Organic compounds, Octanol/water partition coefficient, Pesticides, DDT, Polyaromatic hydrocarbons, Aromatic hydrocarbons, Phthalates.

Binding of organic compounds to dissolved humic and fulvic acids was quantitatively measured. The extent of binding increased with increasing octanol/water partition coefficient and decreasing water solubility. The compounds included fluorene, fluoranthene, di-n-buyl phthalate, dicyclohexylphthalate, 1,2,3-trichlorobenzene, di-(2-ethylhexyl) phthalate, anthracene, lindane, and DDT. Humic acids showed greater binding tendency than fulvic acids. Large variations in binding were observed within a group of different humic acids and within a group of different fulvic acids. Compounds with low log octanol/water partition coefficients such as lindane will probably not bind appreciably in the environment. Compounds with very highg octanol/water partition coefficients such as DDT may bind to a significant extent. DDT binding to humic acid increased with temperature decreases. DDT was also bound to the dissolved organic carbon in sewage effluent. (Cassar-PTT)
W86-03371

COMPARATIVE STUDY OF THE RELATIONSHIPS BETWEEN THE MOBILITY OF ALAHLOR, BUTYLATE, AND METACHLOR IN SOIL AND THEIR PHYSIOCOCHEMICAL PROPERTIES,

Stauffer Chemical Co., Mountain View, CA.
C. J. Spillner, V. M. Thomas, D. G. Takahashi, and H. B. Scher.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 231-247 p, 5 fig, 5 tab, 20 ref.

Descriptors: *Fate of pollutants, *Chemical wastes, Pesticides, Alachlor, Butylate, Metolachlor, Soil, Herbicides, Adsorption, Soil density, Volatility, Soil water.

The order of the mobilites of alachlor, butylate, and metalachlor in columns of various soils was metolachlor>alachlor>butylate. This correlates directly with the water solubilities and inversely to the adsorption coefficients and octanol/water partition coefficients in these compounds. Diffusion of these compounds in soil thin-layers were as follows: butylate>alahlor>metolachlor, which properties affecting diffusion appeared to be bulk density and temperature. Soil moisture is also probably important, but its effect on the diffusion of these compounds was not determined. (Author)
W86-03372

MATHEMATICAL MODELING APPLICATION TO ENVIRONMENTAL RISK ASSESSMENTS,

CIBA-GEIGY Corp., Greensboro, NC. Agricultural Div.
R. C. Honeycutt, and L. G. Ballantine.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 249-262 p, 1 fig, 9 tab, 3 ref.

Descriptors: *Fate of pollutants, *Pesticides, *Model studies, *Risks, Insect growth inhibitors, CGA-72662, SWRRB model, EXAMS model, Mathematical models, Toxicity, Lakes, Ponds, Degradation, Aquatic life, Fish, Daphnia, Rainfall intensity.

The risks of an insect growth inhibitor, CGA-72662, in aquatic environments were assessed using a combination of the SWRRB and EXAMS mathematical models. Specific application rates were put into the model for a pond, a eutrophic lake, and an oligotrophic lake. For the same application rate, the eutrophic lake had greater concentrations of the compound and much longer half-life and self-purification time than the oligotrophic lake. Comparing the concentrations of CGA-72662 in water and sediment with toxicity data showed that aquatic safety factors for bluegill, rainbow trout, channel catfish, and daphnia were on the order of 50 million to 900 million, of no environmental consequence. Model limitations were discussed. Rainfall intensity was one of the most important parameters affecting runoff in SWRRB. EXAMS was very sensitive to application load. (Cassar-PTT)
W86-03373

APPLICATION OF THE PRELIMINARY POLLUTANT LIMIT VALUE (PPLV) ENVIRONMENTAL RISK ASSESSMENT APPROACH TO SELECTED LAND USES,

Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
D. H. Rosenblatt, M. J. Small, and R. J. Kainz.
IN: Fate of Chemicals in the Environment: Compartmental and Multimedia Models for Predictions, American Chemical Society, Washington, DC, 1983. 263-284 p, 2 fig, 5 tab, 32 ref.

Descriptors: *Fate of pollutants, *Water pollution effects, *Chemical wastes, *Model studies, *Risk, Land use, Preliminary Pollutant Limit Value, Toxicity, Public health.

The site-specific Preliminary Pollutant Limit Value (PPLV) process for environmental risk assessment has been applied to contaminated land areas in order to determine what use might be made of them at various levels of contamination. The process involves examination of the potential for each chemical of concern to proceed from the soil or water, through defined pathways, to man or other target organisms. Each pathway is treated as if it consisted of a series of compartments at equilibrium, except that the exposure of man to the last of these compartments is handled as a consumption rate process. The best available toxicological information is used to estimate an acceptable daily dose (Dt) for human (or other organism) exposure to each compound. This value is used to calculate levels of the compound in the soil or water such that Dt is not likely to be exceeded during the course of specified categories of human activity. A PPLV is derived from consideration of the Dt along with the probable exposure level. Four specific examples of the use of the PPLV concept are described. Soil and water PPLVs are developed for several compounds. The PPLVs vary according to envisioned scenario; for example, subsistence farming, residential housing, hunting, fishing, and industrial or timbering operations. Each scenario entails one or more exposure pathways. The PPLVs so derived allow for various options for cleanup or restriction of land use, such that public health will not be jeopardized by residual contamination. Each potential cleanup effort represents a different level of hazard reduction. (Author)
W86-03374

DYNAMICS OF LOTIC SYSTEMS,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5C.
W86-03375

EFFECT OF SIMULATED CANOPY COVER ON REGULATION OF NITRATE UPTAKE AND PRIMARY PRODUCTION BY NATURAL PERIPHYTON ASSEMBLAGES,
Geological Survey, Menlo Park, CA.
F. J. Triska, V. C. Kennedy, R. J. Avanzino, and B. N. Reilly.
IN; Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 129-159, 13 fig, 1 tab, 34 ref.

Descriptors: *Aquatic environment, *Productivity, *Algae, *Nutrient removal, Model studies, Lotic environment, Stream biota, Aquatic productivity, Primary productivity, Microbial studies, Canopy, Nitrates, Cycling nutrients.

To test canopy impact on biological response to a simulated reset, or nutrient input event, an experiment was conducted in five Plexiglas channels set in Little Lost Man Creek in California. An unshaded control channel (40 micrograms nitrate-nitrogen per liter and 10 micrograms phosphate-phosphorous per liter background) received no nutrient addition. Treatment channels (0, 30, 66, and 92% shaded), amended with approximately 100 micrograms nitrate-nitrogen per liter and 25 micrograms phosphate-phosphorous per liter simulated onset of autumnal storms. Periphyton biomass increased at least fivefold except in the 92% shaded channel. Maximum biomass was essentially similar in both the control and the fully lighted treatment channel, but chlorophyll was half as great in the control. Biomass-to-chlorophyll ratio in the control stream increased throughout the experiment, but decreased by half or more in treatment flumes within 4 days. Diel fluctuations in nitrate concentrations were observed, but their magnitude did not increase directly with biomass accumulation because of gradual periphyton senescence. Results suggest that the cycling distance of biologically important nutrients in a stream reach depends on input location on the watershed (stream order and canopy cover) and time elapsed since the previous setting event. (Author)
W86-03382

INVERTEBRATE DRIFT AND PARTICULATE ORGANIC MATERIAL TRANSPORT IN THE SAVANNAH RIVER BELOW LAKE HARTWELL DURING A PEAK POWER GENERATION CYCLE,
Arizona Univ., Tucson. School of Renewable Natural Resources.
W. J. Matter, P. L. Hudson, and G. E. Saul.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 357-370 p, 3 fig, 4 tab, 17 ref.

Descriptors: *Aquatic environment, *Lotic environment, Lotic ecosystems, Stream biota, Aquatic communites, Invertebrate drift, Particulate organic material, Particulate matter, Organic matter.

The Savannah River below Lake Hartwell, Georgia-South Carolina, receives hypolimnetic water discharged from the reservoir for peak-power generation. Invertebrates and particulate organic material (POM) in the water column were collected during a 24 hour release cycle at sites 1.0, 4.5, and 12.5 km downstream from the dam. Water was released during a 6-hr period, reaching a maximum generation discharge of 688 cu m/s. Highest POM concentrations were associated with the initial downstream surge of water at the start of power generation; values were 200 to 400 times greater than those during nongeneration periods. The POM rapidly decreased to less than one-tenth the original surge levels. Much of the POM originated in the tailwater, and concentrations increased at successive downstream sites. Of the drifting invertebrates, 80 to 93% originated in the reservoir. Densities of benthic invertebrates were highest during passage of the initial release surge, whereas densities of invertebrates originating in the reservoir peaked 2 to 3 hours after the initial surge at each station, during maximum release. Evidence of 'behavioral' drift suggested that benthic production may still be in excess, despite repeated 'catastrophic' losses during releases. (Author)
W86-03392

NITRATE-NITROGEN MASS BALANCES FOR TWO ONTARIO RIVERS,
York Univ., Downsview (Ontario).
A. R. Hill.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983, p 457-477, 4 fig, 3 tab, 34 ref.

Descriptors: *Nitrate, *Denitrification, Sinks, Nottawasaga River, Ontario, Duffin Creek, Ontario, Sediments, Aquatic environment, Lotic environment, Microbial studies, Nutrients.

Analysis of nitrogen transport revealed an average daily loss of 45 + or - 9 kg N03-N (160 mg N/sq m)in Duffin Creek and 35 plus or minus 21 kg NO3-N(60 mg N/sq m)in the Nottawasago River during low flows between May and October. Laboratory experiments suggested that most of the nitrate disappearance was caused by denitrification and nitrate reduction in stream sediments. Contrasts in nitrate removal rates in the two rivers probably resulted mainly from differences in sediment characteristics. The Nottawasaga River sediments had very low percentages of organic carbon and silt in comparison to sediments from pool reaches in Duffin Creek. Nitrate losses during stream transport rose rapidly to high levels in May and fell to lower levels in November as water temperature declined. Laboratory experiments suggested that denitrification and nitrate reduction may still occur, although at very low rates, during the winter months when water temperatures in the Nottawasaga River and Duffin Creek are 0 to 2 C. Denitrification was considered to be negligible during major flood events. The removal of nitrate represented 5% of the annual export of nitrogen from the two rivers. In low flow conditions, however between May and October, nitrate losses corresponded to 50% of the average daily input of total nitrogen and 75% of the nitrate input in Duffin Creek. The Nottawasaga River had a much smaller assimilative capacity, removing only about 13% of the daily nitrate input. (Author)
W86-03396

USE OF SOLUTE TRANSPORT MODELS TO ESTIMATE SALT BALANCE BELOW IRRIGATED CROPLAND,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3F.
W86-03402

KILLING RAIN: THE GLOBAL THREAT OF ACID PRECIPITATION,
T. Pawlick.
Sierra Club Books, San Francisco. 1984. 206 p.

Descriptors: *Acid rain, *Acidification, Aquatic environment, Ecosystems, Aquatic life, Environment, Aquatic plants, Aquatic animals, Public health, Political aspects, Legal aspects, Forests.

Various aspects of atmospheric acid deposition and its possible impacts on aquatic and terrestrial ecosystems, and on public health, are presented in a non-technical, primarily anecdotal, format. Topics discussed include the costs of damage thought to result from acid rain, possible impacts to lakes and streams, public health problems related to sulfates and sulfur dioxide emissions, stunted growth and dieback in forests, various forms of atmospheric acid deposition, and U.S.-Canada relations as a result of the acid rain issue. (Halterman-PTT)
W86-03416

MODELING THE FATE OF CHEMICALS IN THE AQUATIC ENVIRONMENT.
Ann Arbor Science, Ann Arbor, MI. 1982. 413 p. Edited by Kenneth L. Dickson, Alan W. Maki, and John Cairns, Jr.

Descriptors: *Model studies, *Fate of pollutants, *Aquatic environment, Pollutants, Ecosystems, Mathematical models, Distribution, Regulations, Legal aspects, Prediction, Hydrologic models, Legal aspects.

The proceedings of a workshop on modeling the fate of chemicals, with an emphasis on aquatic ecosystems, are presented. Specific areas discussed include assessment of modeling the fate of chemicals, modeling the distribution of chemicals, the role of environmental transport and fate models in regulations, environmental compartmentalization, transport and transformation models, partitioning of chemicals in lakes and streams, hydrologic transport, groundwater, complex effluents, model testing, field validation, and legal validation of environmental fate models. (Halterman-PTT)
W86-03417

ASSESSMENT OF MODELING THE FATE OF CHEMICALS IN THE AQUATIC ENVIRONMENT,
Manhattan Coll., Bronx, NY.
D. J. O'Connor, and J. P. St. John.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. 13-34 p, 2 fig, 1 tab.

Descriptors: *Model studies, Pollutants, *Fate of pollutants, Organic wastes, Organic matter, Heavy metals, Metals, Aquatic environment, Ecosystems, Path of pollutants, Sorption, Volatility.

A brief categorization of the state-of-the-art of modeling the fate of chemicals in aquatic environments is presented. The basic principles of modeling include mass balance and dynamic equilibrium. Model components included in the discussion are kinetic and transfer elements, transport regimes and bed characteristics. The chemical transfer mechanisms that are described include sorption/

desorption, volatilization, settling, resuspension, sediment mechanics, and sediment/water diffusive exchange. The discussion of chemical kinetic transformations includes photolysis, hydrolysis, free-radical oxidation, and biodegradation. The ability of a model to reproduce observed conditions is discussed, with emphasis on the dependence on available data, calibration/validation procedures, criteria, and standards. (Halterman-PTT)
W86-03418

MODELING THE DISTRIBUTION OF CHEMICALS IN AQUATIC ENVIRONMENTS,
Oak Ridge National Lab., TN.
G. T. Yeh.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. 35-48 p, 3 fig, 18 ref. EPA-78-D-X0387.

Descriptors: *Model studies, *Path of pollutants, Pollutants, *Fate of pollutants, Aquatic environment, Ecosystems, Public health aspects, Mathematical models, Distribution, Spatial distribution, Temporal distribution.

The prerequisite of modeling the chemical distribution among various carriers in an aquatic ecosystem in order to assess the hazard to the ecosystem and the health of man is discussed. Because of the complexity of various processes in transporting, transferring, and transforming chemicals, mechanistic mathematical models offer the most promising means for describing the spatial and temporal distribution of chemical perturbations to aquatic environments as completely and accurately as possible. The need to determine the appropriate level of resolution is discussed because different levels of resolution often yield very different answers, with lower-level resolution giving more conservative solutions. (Halterman-PTT)
W86-03419

5C. Effects Of Pollution

PRIMARY PRODUCTIVITY IN THE POTOMAC TIDAL RIVER, MARYLAND, MAY 1980 TO AUGUST 1981,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03000

DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER AND ESTUARY, MARYLAND AND VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W86-03012

DATA COMPILATION OF BENTHIC INVERTEBRATES FROM TRIBUTARY STREAMS OF THE YAMPA AND NORTH PLATTE RIVER BASINS, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
L. J. Britton.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-140, 1983. 99 p, 5 fig, 18 tab, 3 ref.

Descriptors: *Water quality, *Aquatic insects, *Benthic invertebrates, *Colorado, Yampa River Basin, North Platte River Basin.

Benthic invertebrates were collected from Trout Creek, Fish Creek, and the Williams Fork (tributaries of the Yampa River in Routt and Moffat Counties), and Little Grizzly and Grizzly Creeks (tributaries of the North Platte River in Jackson County). Stream-sampling sites were upstream and downstream from potential, existing, or historical coal-mining areas. Field water-quality measurements of water temperature, specific conductance, pH, and dissolved oxygen were also made to aid in assessing stream water-quality conditions. The purpose of the study was to describe and quantify the benthic invertebrate communities in selected streams in coal-mining areas. Sampling was conducted on a near bimonthly basis throughout the growing season, beginning in April and May 1980, and continuing through September 1981. This report describes the methods of data collection and presents qualitative and quantitative results of benthic invertebrates and associated water-quality data. (USGS)
W86-03126

COASTAL DEVELOPMENT AND SHELLFISH WATERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5B.
W86-03133

WATER QUALITY CRITERIA FOR PRIMARY NURSERY AREAS IN NORTH CAROLINA,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
Water Quality Section Report No. 84-10, April 1984. 53 p, 9 tab, 5 fig, 141 ref.

Descriptors: *Estuaries, Brown shrimp, *Water quality standards, *North Carolina, Primary nursery areas.

A comprehensive review was made of the environmental factors influencing early development of commercially important fish and shellfish in North Carolina estuarine areas. Brown shrimp was chosen as an indicator species since it is most commercially important and sensitive to nursery areas: Salinities should be maintained between 8 and 300 parts per thousand. Bottom temperatures should be maintained between 20 and 30 C. The natural seasonal temperature and salinity patterns should not be changed. Water Quality standards are proposed for a variety of parameters. Additional regulatory steps are outlined for establishing a primary nursery area classification.
W86-03134

EFFECTS ON WATER QUALITY OF COAL MINING IN THE BASIN OF THE NORTH FORK KENTUCKY RIVER, EASTERN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03136

ECOLOGICAL STUDIES OF WOOD-BORING BIVALVES IN THE VICINITY OF THE OYSTER CREEK NUCLEAR GENERATING STATION,
Academy of Natural Sciences of Philadelphia, PA.
K. E. Hoagland.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2727, Price codes: A03 in paper copy, A01 in microfiche. NUREG/CR-2727, Vol. 4, December 1982. 36 p, 20 tab, 8 ref, 1 append.

Descriptors: *Nuclear powerplants, *Mollusks, *Temperature effects, *Thermal pollution, *Species composition, Fouling, Thermal water, Thermal powerplants, Termal stress, Water pollution effects, Estuaries, Bays, Population dynamics, Aquatic populations, Salinity, Water temperature.

The species composition, distribution, and population dynamics of wood-boring bivalves are being studied in the vicinity of the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Untreated wood test panels are used to collect organisms at 12 stations, some of which are control stations and some of which are under the thermal influence of the nuclear powerplant. Physiological tolerances of three species are also under investigation in the laboratory. Competition among the fouling species is being studied. Adult populations of the shipworm Teredo bartschi existed in both Oyster Creek and Forked River the summer of 1982, but the species was rare. There was no large settlement of this or any other teredinid species in Barnegat Bay. Teredo navalis was the most common species in the monthly panels. The fouling community reached its maximum yearly diversity in June-July. There was a thermal effluent causing a water temperature change of 3-4 degrees during most of the summer, and salinity in Oyster Creek and Forked River was similar to that of Barnegat Bay. The lack of a shipworm outbreak in 1982 may be related to the low temperature changes in summer, plus the lack of a thermal effluent in the preceding winter-spring period. (Geiger-PTT)
W86-03230

EFFECTS OF CHLORINE ON FRESHWATER FISH UNDER VARIOUS TIME AND CHEMICAL CONDITIONS: TOXICITY OF CHLORINE TO FRESHWATER FISH,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
A. S. Brooks, J. M. Bartos, and P. T. Danos.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-905841, Price codes: A04 in paper copy, A01 in microfiche. EPRI-EA--2481, July 1982. Final Report. 2 p, 13 fig, 12 tab, 24 ref. 1435-1.

Descriptors: *Bioassay, *Water pollution effects, *Chlorine, *Chloramines, Residual chlorine, Toxicity, Emerald shiner, Channel catfish, Rainbow trout.

Laboratory bioassays to determine the acute toxicity of monochloramine, dichloramine, hypochlorous acid and hypochlorite ion, conducted on emerald shiners, channel catfish, and rainbow trout, are described. The emerald shiner was the most sensitive fish studied, averaging 1.8 times more sensitive to chlorine than channel catfish and 3.3 times more sensitive than ranbow trout. Actual LC50 values varied with length of exposure. Monochloramine was found to be 2.4 - 3.5 times less toxic than dichloramine, 2.5 - 3.4 times less toxic than hypochlorous acid, and 1.3 - 1.4 times less toxic than hypochlorite ion, depending on the species of fish tested. The suggestion that careful attention should be paid not ony to total residual chorine but to the duration of exposure, and to both chlorine and fish species presented in establishing safe effluent limitations, is discussed. (Halterman-PTT)
W86-03231

PROCESSES OF ATMOSPHERIC DEPOSITION OF METALS AND ACIDS TO FORESTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W86-03236

ACIDITY, NUTRIENTS, AND MINERALS IN ATMOSPHERIC PRECIPITATION OVER FLORIDA: DEPOSITION PATTERNS, MECHANISMS, AND ECOLOGICAL EFFECTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W86-03246

PLANT RESPONSE TO AQUEOUS EFFLUENTS DERIVED FROM IN SITU FOSSIL FUEL PROCESSING PART II: FIVE GRASS PLANT SPECIES AND THEIR RESPONSE TO FIVE PRODUCED RETORT WATERS; OIL SHALE, TAR SANDS AND UNDERGROUND COAL GASIFICATION,
Wyoming Univ., Laramie. Range Management Div.
Q. D. Skinner.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-002785, Price codes: A05 in paper copy, A01 in microfiche. DOE/LC/01761-T4 (Pt. 2), November 1981.nal Report. 85 p, 7 fig, 2 tab, 3 ref, 5 append.

Descriptors: *Oil shale, *Plant growth, *Oil recovery, *Grasses, *Water pollution effects, Ecological

effects, Industrial wastes, Fuel reprocessing, Fuel, Coal gasification, Fate of pollutants, Statistical analysis, Process water.

Five in situ produced waters collected from retorting oil shale and tar sands to produce oil and coal to produce gas were tested for their effect on plant growth. Five native grass plant species were utilized for leaf area, root/shoot ratio and shoot/leaf area ratio were parameters measured. All experiments were conducted under greenhouse conditions using hydroponic techniques and commercial grade perlite as support systems. Measurements were collected after a 10 week growth period. Factor analyses of variance revealed differences existed between waters and their effect on plants for all six parameters measured except shoot/leaf area ratio were parameters measured. All experiments were conducted under greenhouse conditions using hydroponic techniques and commercial grade perlite as support systems. Measurements were collected after a 10 week growth period. Factor analyses of variance revealed differences existed between waters and their effect on plants for all six parameters measured. Differences among dilution treatments were significant for all parameters measured except shoot/leaf area ratio. There were no differences in water-treatment interactions. Collectively, the six parameters utilized in the study separated responses of plants tested to treatments of various in situ produced retort waters. Comparing response of different species to each water is subjective due to varying capabilities among plant species to grow under the given experimental system due to their different genetic characteristics. Overall, Tar Sands had the least effect on plant species, whereas 150-T Retort water (simulates in situ oil shall processing) caused death to more species than any other aqueous effluent tested. (Geiger-PTT)
W86-03248

PLANT RESPONSE TO AQUEOUS EFFLUENTS DERIVED FROM IN SITU FOSSIL FUEL PROCESSING PART I. EIGHT PLANT SPECIES AND THEIR RESPONSE TO OMEGA 9 OIL SHALE RETORT WATER,
Wyoming Univ., Laramie. Range Management Div.
Q. D. Skinner.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83003784, Price codes: A04 in paper copy, A01 in microfiche. DOE/LC/01761-T4 (Pt. 1), November 1981. Final Report. 60 p, 2 fig, 2 tab, 9 ref, 5 append.

Descriptors: *Plant growth, *Oil shale, *Ecological effects, *Water pollution effects, *Oil recovery, Industrial wastes, Fate of pollutants, Grasses, Fuel, Fuel reprocessing.

Problems reside in the handling, containment, treatment, disposal, use, and eventual fate of waters associated with synfuel processing techniques. Plant growth response to oil shale report water collected from the 1976 Rock Springs Site 9 true in situ oil shale combustion experiment conducted by the Laramie Energy Technology Center was investigated. The purposes of the present study were to evaluate the effect of retort water on plants and document effective parameters for detecting differences in plant growth by species. A self-feeding hydroponic system was used to subject different dilutions of oil shale retort water to plants grown in horticulture grade perlite under greenhouse conditions for 10 weeks. Parameters measured included leaf area, total dry weight, shoot weight, root weight, root/shoot ratio and shoot/leaf area ratio. Seven grass and one forb species were utilized as test plants. Results showed that growth was impaired when plants were subjected to retort water. Species response to retort water varied. The parameters measured also varied as to their ability to detect change in growth response due to exposure of plants to retort water. This study shows that methods utilized can provide a separation of plant species to one in situ oil shale retort water. These methods should give controlled technology flexibility based on potential toxicity for selecting plant species for reclamation of mined sites and for testing water treatment effects. (Geiger-PTT)
W86-03249

PLANT RESPONSE TO AQUEOUS EFFLUENTS DERIVED FROM IN SITU FOSSIL FUEL PROCESSING PART III: THREE GRASS SPECIES AND THEIR RESPONSE TO OMEGA 9 AND TO FIVE PRODUCED RETORT WATERS; OIL SHALE, TAR SANDS AND UNDERGROUND COAL GASIFICATION.
Wyoming Univ., Laramie. Range Management Div.
Q. D. Skinner.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83003786, Price codes: A04 in paper copy, A01 in microfiche. DOE/LC/01761-T4 (Pt. 3), December 1981, Final Report. 63 p, 7 fig, 41 tab, 5 ref, 4 append.

Descriptors: *Fuel reprocessing, *Process water, *Oil shale, *Plant growth, *Water pollution effects, Fuel, Coal, Oil, Industrial wastes, Coal gasification, Groundwater pollution, Fate of pollutants, Ecological effects, Grasses, Oil recovery.

Six in situ produced waters, collected from retorting oil shale and tar sands to produce oil and coal to produce gas, were tested for their produced waters diluted by groundwater and those that remain undiluted. Three native grass species (basin wildrye, western wheatgrass, and alkali sacaton) were used to monitor growth response under greenhouse conditions using hydroponic techniques and commercial grade perlite as support systems. Measurements were collected on root weight, shoot weight, total dry weight, leaf area, root/shoot ratio and shoot/leaf area ratio after a 10-week growth period. Results showed that different process waters collected from retorting oil shale, tar sands, and coal, affect plant species in diffeent ways and to different degrees. However, in general, retort waters diluted by groundwater were less toxic to plant species tested than were the undiluted counterparts. Parameters measured and experimental design did separate reaction of plant species to various in situ retort waters. (Geiger-PTT)
W86-03253

REVIEW OF THE IMPACT OF COPPER RELEASED INTO MARINE AND ESTUARINE ENVIRONMENTS,
Lawrence Livermore National Lab., CA.
F. L. Harrison.
NUREG/CR-2823, UCRL-53042, November 1982, 119 p, 29 tab, 390 ref.

Descriptors: *Marine environment, *Estuarine environment, *Copper, Estuarine fishes, Marine fishes, Heavy metals, Environmental effects, Toxicity, Invertebrates.

Information on the concentrations of copper in abiotic and biotic compartments of marine and estuarine ecosystems and the effect on biota of increased amounts of copper in the water and the sediments were reviewed. Data compiled and discussed include the quantities and physicochemical forms of copper in the water column, the concentrations of copper in the bedload sediments and interstitial waters, and the concentrations of copper in primary producers, annelid worms, molluscs, crustacea, minor invertebrates, and fishes. In addition, the acute and sublethal effects of copper on the same groups of biota are presented as well as data on copper concentration factors. This information can be used to evaluate, for different types of ecosystems, the ranges of concentrations that occur in nature, to identify ecosystems that are or may be impacted by copper released from industrial and urban sources, and to assess the effects on biota of the use of copper alloys in nuclear power station cooling systems. (Author)
W86-03265

WYCOALGAS COAL GASIFICATION PROJECT: PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 1,
Woodward-Clyde Consultants, San Francisco, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-001083, Price codes: A17 in paper copy, A01 in microfiche. DOE/RA/50404--1232-App.Q-Vol. 1, August 1981. 393 p, 144 fig, 93 tab. DE-F-CO2-81RA50404

Descriptors: *Coal gasification, *Environmental impact statement, Coal mines, Environmental effects, Siting, Environmental protection, Water pollution control, Environmental quality, Groundwater, Wildlife, Aquatic environment.

An environmental impact statement for a proposed coal gasification plant is presented. The topics discussed in this volume include project background and organization, the purpose and need of the plant, a detailed description of the proposed plant, a description of the water supply system, the product pipeline, the railroad, the coal mine, and the interrelationships of the proposed plant with other planned projects. The environmental effects of the proposed plant are also described, emphasizing air quality, soils, hydrology and water quality, vegetation, wildlife, aquatic biology, rare and endangered species, recreation resources, visual resources, land use, cultural resources and socioeconomics. (Halterman-PTT)
W86-03271

ACID PRECIPITATION: A CRITIQUE OF PRESENT KNOWLEDGE AND PROPOSED ACTION,
Virginia Center for Coal and Energy Research, Blacksburg.
For primary bibliographic entry see Field 5B.
W86-03273

ASSESSMENT OF IMPLANTED SUBSTRATE SAMPLERS FOR MACROINVERTEBRATES INHABITING STONE DIKES OF THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. B. Mathis, C. R. Bingham, and L. G. Sanders.
Miscellaneous Paper E-82-1, U.S. Army Environmental and Water Quality Operational Studies, February 1982. Final Report. 55 p, 3 fig, 13 tab, 41 ref.

Descriptors: *Ecological effects, *Dikes, *Aquatic populations, *Environmental effects, *Biological samples, *Levees, *Aquatic insects, *Macroinvertebrates, Aquatic animals, Substrates, Sampling, Water sampling, Crustaceans, Isopods, Caddisflies, Mayflies, Midges, *Mississippi River.

The aquatic macroinvertebrate assemblage of a dike in the Lower Mississippi River was evaluated by implanting substrate basket samplers into the structure. The resulting data indicated that a diverse (38 taxa) and productive (average density = 101,968.4 organisms/sq m) assemblage was present, and was characterized by net-spinning caddisflies, tube-building chironomids, clinging mayflies, and isopods. A comparison of the surface stones of the basket samplers with adjacent surface stones of the dike indicated that the implanted substrates provided representative estimates of both the composition and structure of the macroinvertebrate assemblage. These data also indicated significant macroinvertebrate activity below the surface substrate of the dike. Differences in habitat conditions among dike positions (downstream, top, upstream) were the major contributors to overall sample variability. Thus, stratified random sampling based on dike position is recommended for future comparative studies. (Author)
W86-03309

CONSIDERATIONS IN SELECTING BIOASSAY ORGANISMS FOR DETERMINING THE POTENTIAL ENVIRONMENTAL IMPACT OF DREDGED MATERIAL,
EG and G Bionomics, Pensacola, FL. Marine Research Lab.
P. J. Shuba, S. R. Petrocelli, and R. E. Bentley.
Technical Report EL-81-8, Army Engineer Waterways Experiment Station, Vicksburg, MS., September 1981. Final report. 86 p, 4 tab, 1 app, 50 ref.

DACW39-78-C-0093.

Descriptors: *Bioindicators, *Bioassays, *Indicators, *Aquatic animals, *Dredging, *Bioaccumulation, *Environmental impact statement, Literature review, Assay, Biological samples, Ecological effects, Environmental effects, Water pollution effects.

A list of factors was developed to aid in the selection of test species for bioassay and bioaccumulation potential studies with dredged material. Factors to be considered for the selection of test species include whether the organism was indigenous to the disposal site or closely related to an indigenous species; was available through collecting or purchasing; had a toxicological data base; could be maintained and cultured in the laboratory; was useful in acute, chronic, and bioaccumulation tests; was ecologically and economically important; had a wide geographic distribution, and was compatible with other test species in the test containers. For the selection of test species to determine bioaccumulation potential in the laboratory, the same factors were used but with the stipulation that the organism be large enough to provide sufficient tissue for chemical analyses and that they survive the 10-day exposure period. Based on a literature review, a 10-day exposure period was sufficient to qualitatively determine if most chemical contaminants would be accumulated from dredged material by test organisms and was a useful tool in evaluating the potential environmental impact of dredged material.
W86-03319

HEAVY METALS POLLUTION OF THE UPPER ARKANSAS RIVER, COLORADO, AND ITS EFFECTS ON THE DISTRIBUTION OF THE AQUATIC MACROFAUNA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5B.
W86-03338

ENVIRONMENTAL PROTECTION: STANDARDS, COMPLIANCE AND COSTS,
For primary bibliographic entry see Field 5B.
W86-03344

NATURE AND CONCENTRATION OF POLLUTANTS IN WATER,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5B.
W86-03346

ROLE OF TOXICOLOGY,
Water Research Centre, Medmenham (England). Medmenham Lab.
J. K. Fawell.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd., Chichester, England, 1984. 72-84 p, 3 fig, 3 tab, 16 ref.

Descriptors: *Aquatic environment, *Environmental protection, *Toxicity, *Bioassay, Carcinogenicity, Mutagenicity, Epidemiology, Teratology.

The assessment of the probability of occurrence of toxic effects is a relatively new field and one which presents particular difficulty for toxicologists. Because the potential for exposure of most of the population through water is enormous, a great responsibility rests with industry to ensure their own actions do not create new problems while solving others. To provide a proper framework for toxicological endeavors, the author discusses a variety of aspects of this important area of study. First, there are a number of aspects of the biological activity of a compound, including acute toxicity, chronic toxicity, carcinogencity, mutagenicity, reproductive toxicity, metabolism, and pharmacokinetics. Second, there is information from special studies such as behavior, immuno-toxicity and allergic responses. The value of information resulting from testing is also discussed; several pitfalls of using toxicity data are outlined. Finally, the use of toxicity data in environmental protection and future research needs are discussed.
W86-03347

EPIDEMIOLOGY AND WATER QUALITY,
London School of Hygiene and Tropical Medicine (England). Dept. of Medical Statistics and Epidemiology.
P. Fraser.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 85-93 p, 26 ref.

Descriptors: *Aquatic environment, *Epidemiology, *Toxicity, *Water pollution, Great Britain, Water pollution effects, Carcinogenicity, Nitrogen, Public health.

Examples of the spread of disease resulting from poor water quality are discussed in this paper. Swimming-associated illnesses are mainly gastrointestinal problems, arising from swimming in contaminated water. Cardio-vascular disease appears to be associated with consumption of hard water, but the exact relationship or possible mechanisms are not understood. The disease methaemo-globinaemia has been shown to be related to nitrates in water. Although the exact role of nitrate pollution in the spread of this disease is not known, it does occur primarily in countries where water quality is low. Nitrates have also been implicated in cases of stomach cancer. The author points out, however, that recent studies conducted in England, Italy, Chile, Denmark, Hungary and France did not reveal a link between water-borne nitrates and cancer. Finally, although a controversy existed in which fluoridation of water linked to cancer, subsequent research has indicated that there is no link between the two. (Halterman-PTT)
W86-03348

ECOTOXICOLOGY AND ENVIRONMENTAL QUALITY,
Ministerie van Volkshuisvesting en Ruimtelijke Ordening, Leidschendam (Netherlands).
W. H. Konemann.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 94-103 p, 3 fig, 3 tab, 12 ref.

Descriptors: *Aquatic environment, *Toxicity, *Bioassay, *Environmental protection, Median tolerance limit, Mortality, Algae, Fish, Zooplankton.

The role of ecotoxicology in environmental protection is discussed in order to describe the extent to which it helps to improve or defend the quality of the environment. First, the goals of ecotoxicology were defined as (a) the prediction of levels of chemicals which do not have a negative impact on environmental quality; (b) the identification of chemicals responsible for poor environmental quality; and (c) the monitoring of the actual quality of surface water. Second, the currently used ecotoxicity tests are described. Of primary interest are the no-effect-levels, LC50-mortality type tests, immobilization tests such as the Daphnia EC50, and algal growth tests. Third, several aspects of toxicity testing are discussed: the importance of knowing the form or species of the test compound, the uses and limitations of multiple species tests, and the problems of testing mixtures of chemicals. It is concluded that a set of about five acute tests and two chronic tests is sufficient for thorough ecotoxicity testing. Safety factors are necessary because of differences between the real environment and the laboratory. (Halterman-PTT)
W86-03349

STANDARDS AND LIMITS FOR WATER QUALITY CONTROL,
Water Research Centre, Medmenham (England). Medmenham Lab.
R. F. Packham.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 108-122 p, 3 tab, 19 ref.

Descriptors: *Aquatic environment, *Standards, *Toxicity, *Bioassay, Median tolerance limit, Mortality, Microbiological studies, Chemical composition, Radioactivity.

Despite all of the uncertainties involved in setting limits for water constitutents, they are useful and even vital in many aspects of water quality management. The number of limits established for various purposes will continue to grow and some of the present uncertainties will diminish as a result of research. This paper addresses several aspects of standards and limits for water quality, with emphasis on some specific research needs and some suggested guidelines for the implementation of standards and limits. The relative toxicity of different chemical species of the same element, and the toxicity of mixtures of substances, are problems which need more research. One of the major guidelines suggested for the use of standards is that when standards are exceeded, all aspects of the contamination should be investigated, including its significance to health in the local context. Obviously, the need to safeguard public health and environmental quality is unquestionable, but excessive safety margins have important cost implications which cannot be ignored. (Halterman-PTT)
W86-03350

MONITORING COMPLIANCE WITH STANDARDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
J. C. Ellis, and D. G. Miller.
IN: Enviromental Protection: Standards, Compliance, and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 123-139 p, 11 fig, 3 ref, 1 append.

Descriptors: *Aquatic environment, *Monitoring, *Toxicity, Standards, Water quality standards, Specifications, Environmental protection.

With the move toward increasing legislation and the tendency to prefer a more rigorous numerical approach to standards, operating agencies are being obliged to examine in more detail a variety of measures covering the field of environmental protection. This paper reviews the statistical principles involved in compliance monitoring, and sets out the compromises necessary in practice. The conclusions drawn from this review are as follows: All persons involved in monitoring must come to terms with the limitations of practical monitoring schemes. Those entrusted with operational functions should give priority to protection of life, but should allowed flexibility in reacting to standards infringements. Fuller use should be made of the scientific knowledge of systems and of the underlying statistical relationships involved in monitoring. Concentrated surveys, which would define underlying trends, should be followed by long-term, less intensive monitoring. Finally, uniform approaches which ignore local factors are unlikely to be cost-effective.
W86-03351

EUROPEAN COMMUNITY POLICY ON ENVIRONMENTAL MANAGEMENT,
Commission of the European Communities, Brussels (Belgium).
A. J. Fairclough.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 158-168 p, 21 ref.

Descriptors: *Aquatic enviroment, *Environmental protection, *Standards, *Enviromental management, Europe.

The European Community approved the first 'Action Program' in 1973. The aim was to ensure the sound management of natural resources and to bring qualitative aspects into the planning and organization of economic and social development. This paper describes the origin of the Environmental Action Program, indicates the rationale for its existence, reviews its achievements, and describes its effects on the field of water pollution control. Some 70 legislative measures, many of which deal with water pollution, have been adopted in the ten years between the adoption of the program and the writing of this paper. The Dangerous Substances Directive, a number of directives dealing with surface water, drinking water, bathing water, freshwater fish and shellfish, and finally, a series of

directives pertaining to certain specific industrial processes were among the major actions in the field of water pollution control. The authors conclude with a discussion of the importance of sound, forward-looking enviromental policy in the whole body of the socio-economic policies. (Halterman-PTT)
W86-03353

APPROACH OF THE FEDERAL GERMAN REPUBLIC-ANTICIPATING ENVIRONMENTAL EFFECTS,
Council of Experts on Environmental Matters, Bonn (Germany, F.R.).
J. Salzwedel.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 167-180 p.

Descriptors: *Aquatic environment, *Environmental protection, *Standards, Federal German Republic, Enviromental effects.

A primary requirement of the management of water resources by the authorities is the task of regulating effluent disposal in such a way as not to place the public water supply at risk. Up to the promulgation of the Federal German Republic's Fourth Amendment to the Water Resources Policy Act, only the public water supply received special recognition in federal law. Specifically, authorization and permission for water use were to be refused if the use was prejudiced to public well being, particulary if it was expected to pose a threat to public water supply. On the other, hand, it was left to the discretion of management to ensure that the requirements for proper effluent disposal were duly met. The 1976 Amendment Four of the Water Act, however, listed provisions which included the introduction of liability for effluent disposal planning, and the ad hoc application of the Water Law to indirect dischargers. Furthermore, minimum requirements for production and purification technology are outlined. (Halterman-PTT)
W86-03354

UK APPROACH - ENVIRONMENTAL QUALITY STANDARDS,
Department of the Environment, London (England).
J. A. L. Gunn.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 181-188 p.

Descriptors: *Aquatic environment, *Environmental protection, *Standards, Environmental effects, United Kingdom, Enviromental management, Europe, Water quality standards, Toxicity.

The principles on which water pollution control policies are currently founded in the United Kingdom are explained. There are four basic principles. First, a single authority exercises control over all discharges within a river basin, and provides water services throughout the area of that river basin. This is the principle of unified management. Second, dischargers are required to meet conditions which are set by reference to the enviromental quality objective propounded for the receiving water. This is the principle of using environmental quality objectives. Third, the polluter should pay the cost of the measures necessary to avert, reduce or remedy any pollution he causes. This is the polluter pays principle. Fourth, in environmental matters the British Government participates constructively in the work of the European Community and complies with its requirements. This principle is referred to as the European Community commitment. The author expresses his belief that together, these principles should provide a sound basis for the development of policy and practice in the protection of the aquatic environment. (Halterman-PTT)
W86-03355

SPILLAGES-AN OPERATIONAL APPROACH,
Wessex Water Authority, Bristol (England).
For primary bibliographic entry see Field 5G.
W86-03357

CONTINGENCY PLANNING FOR CHEMICAL ACCIDENTS,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
For primary bibliographic entry see Field 5G.
W86-03358

PROTECTION OF THE AQUATIC ENVIRONMENT - RESEARCH NEEDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
S. C. Warren.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. p 283-294, 2 tab.

Descriptors: *Aquatic environment, *Environmental protection, *Public health, Wastewater facilities, Environmental quality, Ocean dumping, Acid rain, Sewage sludge, Sewage treatment, Chemical wastes.

Despite the hope that economic factors should not be allowed to impede environmental improvements, in practice they will. It is essential that the money available for environmental protection be spent where it will do the most good. Environmental concern can be divided into three major categories: risk of damage to human health, the 'ecological balance', and the aesthetic aspects of the environment. Research on the impact of a variety of possible pollutants on these three areas is clearly needed. Some of the more critical areas are heavy metals, nitrate, oxides of nitrogen and sulphur, organic compounds, sewage effluent and sludge, agricultural wastes, and the exploitation of the environment in the forms of farming and forestry, angling, land drainage, and river improvements. Both basic and applied research are needed to provide the information needed to adequately address the many issues that exist regarding these research needs. (Halterman-PTT).
W86-03361

APPLICATION OF THE PRELIMINARY POLLUTANT LIMIT VALUE (PPLV) ENVIRONMENTAL RISK ASSESSMENT APPROACH TO SELECTED LAND USES,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W86-03374

DYNAMICS OF LOTIC SYSTEMS,
Savannah River Ecology Lab., Aiken, SC.
Ann Arbor Science, Ann Arbor, MI. 1983. Edited by Thomas D. Fontaine, III and Steven M. Bartell. 494 p.

Descriptors: *Aquatic environment, *Lotic environment, Stream biota, Productivity, Aquatic productivity, Primary productivity, Secondary productivity, Consumers, Aquatic communities, Microbial studies, Invertebrates, Nutrients, Denitrification.

Increases in the number of stream ecologists, technical articles, and frequency of special symposia on lotic ecosystems reflect a growing interest in the structure and function of streams and rivers. While progress has been made in many areas of specialization related to lotic ecosystem studies, communication across borderlines of separate disciplines has been all too infrequent. The purpose of the symposium, published in these proceedings, was to provide a format for the assembly of individuals from academia, industry, and government to explore a variety of factors that govern the structure and function of flowing water systems. The major topics covered include system concepts, synthesis studies, dynamics, and control of system components, consumers, detritus and nutrients. (Halterman-PTT)
W86-03375

RESOURCE SPIRALING: AN OPERATIONAL PARADIGM FOR ANALYZING LOTIC ECOSYSTEMS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. W. Elwood, J. D. Newbold, R. V. O'Neill, and W. Van Winkle.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 3-27 p, 4 fig, 1 tab, 67 ref.

Descriptors: *Stream biota, *Streams, *Lotic environments, Nutrients, Cycling nutrients, Nutrient spiraling theory, Organic carbon, Organic matter, Detritus, Model studies.

The cycling of nutrients and organic carbon within a stream is a critical process driving the aquatic ecosystem. A conceptual view of this phenomenom is spiraling, defined as the spatially dependent cycling of nutrients and the processing of organic matter in lotic ecosystems. This view provides a framework for describing and measuring the temporal and spatial dynamics of nutrients and organic carbon. The authors conclude that nutrient spiraling length and organic carbon turnover length are indices of the use of these resources supplied from the surrounding watershed relative to their rate of downstream transport. Furthermore, nutrient spiraling in most undisturbed streams is predominantly a biotic process involving the sorption, retention and turnover of nutrients by microbes. Shortening of the spiraling length is associated with increased productivity. Further use of the spiraling concept will allow an examination of the many complex community- and system-level interactions in streams and rivers to better understand their longitudinal interdependencies and mechanisms in stream communities for stabilizing the supply of nutrients and energy resources. (Halterman-PTT)
W86-03376

SERIAL DISCONTINUITY CONCEPT OF LOTIC ECOSYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
J. V. Ward, and J. A. Stanford.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 29-42 p, 3 fig, 34 ref.

Descriptors: *Aquatic environment, *Lotic environment, Stream biota, Stream order, Reservoirs, Aquatic productivity, Aqquatic communities, Microbial studies, Nutrients, Detritus, Controlled streams, Serial discontinuity.

The theoretical concepts of lotic ecosystems centering on the river continuum concept, which describes the gradient of physical conditions and resulting biotic responses from the headwaters to the mouths of rivers, and nutrient spiraling, concerned with the unidirectional and biologically mediated recyling of nutrients along a river continuum, do not provide for the effects of impoundments on lotic reaches. The work described in this paper is an attempt to attain a broad theoretical perspective of regulated lotic systems over the entire longitudinal stream profile. Discontinuity distance (DD), defined as the longitudinal shift of a given parameter by stream regulation, may be positive (downstream shift), negative (upstream shift), or near zero. The direction and intensity of DD vary as functions of the specific parameter examined and the position of the dam(s) along the longitudinal stream profile. The serial discontinuity concept can be applied to physical parameters (e.g., temperature summation) and biological phenomena at the population (e.g., species abundance patterns), community (e.g., biotic diversity), or ecosystem levels (e.g., photosynthesis/respiration). (Author)
W86-03377

CONCEPTUAL FRAMEWORK FOR PROCESS STUDIES IN LOTIC ECOSYSTEMS,
Oregon State Univ., Corvallis. Dept. of Botany and Plant Physiology.
C. D. McIntire.
IN: Dynamics of Lotic Systems, Ann Arbor Sci-

ence, Ann Arbor, MI. 1983. 43-68 p, 6 fig, 7 tab, 19 ref.

Descriptors: *Lotic ecosystems, *Model studies, Aquatic environment, Functional groups, Aquatic productivity, Cycling nutrients, Decomposing organic matter, Invertebrates, Stream biota, Microbial studies.

This paper presents an approach to lotic ecosystem studies based on the concept of relevant dynamic processes. A process is defined as a systematic series of actions relevant to the dynamics of the system as it is modeled. Each process is expressed as a set of variables, and state variables represent either biomass or process capacity, depending on whether or not qualitative aspects within a process are represented. Process dynamics in lotic ecosystems are discussed relative to (1) the potential to expand process capacity, (2) process production, (3) realized growth of process capacity, and (4) process regulation. A set of variables are defined which aid in the investigation of mechanisms regulating process dynamics in lotic ecosystems. Process models are discussed in relation to their role in hypothesis generation, data assessment, and the setting of research priorities. Specific hypotheses relative to process dynamics in lotic ecosystems are proposed and related to the behavior or a lotic ecosystem model. (Author)
W86-03378

PREDICTABILITY OF STREAM ECOSYSTEM MODELS OF VARIOUS LEVELS OF RESOLUTION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2H.
W86-03379

ALTERNATIVE FOR CHARACTERIZING STREAM SIZE,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 2E.
W86-03380

RIVER WASTE HEAT ASSIMILATION VS. ORGANIC WASTE DISCHARGE,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
E. F. Joeres, and N. Tetrick.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 103-125, 9 fig, 4 tab, 15 ref.

Descriptors: *Waste heat, *Thermal pollution, *Wastewater pollution, Wastewater oxidation, Power plants, Wisconsin River, Lake Wisconsin, Model studies, Biological oxygen demand, Dissolved oxygen.

The issue of water as a constraint to power plant siting was investigated at the Wisconsin River between Wisconsin Dells and Lake Wisconsin. This stretch of river has been the subject of much interest since the construction of the 1000-MW coal-fired Columbia power plant. An attempt was made to determine future trade-offs between using the river for waste heat assimilation or organic waste discharge. Simulations of water quality were carried out to evaluate the effect of potential heat discharges from projected power plants at three possible sites on the levels of dissolved oxygen, biochemical oxygen demand, and algae growth during periods of extremely low flow. Model parameters, boundary conditions, and assumptions made to specify the hydraulic parameters of the system to model the river are discussed. Results indicate that future development along the river will adversely affect dissolved oxygen levels in Lake Wisconsin (dropping to 4 mg/l at one point), but that nutrient loadings are of greater consequence than waste heat discharges. Neither waste heat nor nutrient discharges were found to limit projected biochemical oxygen demand levels caused by organic waste discharges. (Author)
W86-03381

ENERGY BASIS OF ECOSYSTEM CONTROL AT SILVER SPRINGS, FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2H.
W86-03383

ALTERATIONS IN THE BIODYNAMICS OF THE RED CEDAR RIVER ASSOCIATED WITH HUMAN IMPACTS DURING THE PAST 20 YEARS,
Michigan State Univ., East Lansing. Dept. of Zoology.
T. M. Burton, and D. L. King.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 181-197, 3 fig, 4 tab, 27 ref. A-099-MICH.

Descriptors: *Aquatic environment, *Lotic environment, *Ecosystems, Algae, Organic matter, Primary productivity, Sedimentation, Nutrients, Red Cedar River, Michigan, Phosphorous, Periphyton, Macrophytes.

In recent years efforts to improve water quality in streams have intensified. Because of the passage of the Federal Water Pollution Control Act, most point sources of pollution now receive best practicable wastewater treatment. However, the effects of this upgrading of treatment of point-source pollution in receiving waters has not been studied in detail. This paper presents data from studies that do illustrate the long-term changes in a stream with point sources. After a 20-year period, total annual phosphorous discharge from the upper portion of Red Cedar River Michigan has increased 2.4-fold. Discharge of phosphorous from the lower portion only increased 1.2-fold. Sediment accrual, macrophyte productivity, and periphyton production have all declined. Nutrient loading is essentially the same for an upstream and a downstream station, meaning nutrient input is from diffuse sources. (Halterman-PTT)
W86-03384

SIGNIFICANCE OF FLOODPLAIN SEDIMENTS IN NUTRIENT EXCHANGE BETWEEN A STREAM AND ITS FLOODPLAIN,
East Carolina Univ., Greenville, NC. Dept. of Biology.
M. M. Brinson, H. D. Bradshaw, and R. N. Holmes.
In: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 199-221, 7 fig, 1 tab, 31 ref. B-114-NC.

Descriptors: *Sediments, *Nutrients, *Nitrogen, *Phosphorous, *Cycling nutrients, Aquatic environment, Ecosystems, Tar River, North Carolina, Flood plains, Mud-water interfaces.

A year-long comparison of stream channel and floodplain water of the lower Tar River, North Carolina, established that hydrologic phases resulting in water flow from floodplain to stream channel would dilute nitrate (and usually ammonium) concentrations in stream water. In contrast, floodplain drainage water would normally augment filterable reactive phosphorous in the stream. Nitrate loss exceeded ammonium loss from surface water to which these ions were added above background levels. Loss rates of both ions were greater in July and November than in February, the coldest month. Nitrogen-15 trace experiments confirmed a one-way path of nitrate from the surface water; this was made possible by denitrification in the sediments. Ammonium diffusion was bidirectional between surface water and sediments. Background concentrations of inorganic nitrogen in interstitial water of surface sediments underwent greatest changes during warm season dry down. Loss of 32PO4 from surface water was mostly by abiotic mechanisms during all seasons and was entirely so during the coldest part of the year. (Author)
W86-03385

INFLUENCE OF HYDROLOGIC VARIATIONS ON PHOSPHORUS CYCLING AND RETENTION IN A SWAMP STREAM ECOSYSTEM,
North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 2H.
W86-03386

ORGANIC CARBON SUPPLY AND DEMAND IN THE SHETUCKET RIVER OF EASTERN CONNECTICUT,
East Carolina Univ., Greenville, NC. Dept. of Biology.
For primary bibliographic entry see Field 2E.
W86-03387

AQUATIC MACROPHYTE CONTRIBUTION TO THE NEW RIVER ORGANIC MATTER BUDGET,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 2E.
W86-03388

PRIMARY PRODUCTION AND DECOMPOSITION OF SUBMERGENT AND EMERGENT AQUATIC PLANTS OF TWO APPALACHIAN RIVERS,
North Texas State Univ., Denton. Inst. of Applied Sciences.
J. H. Rodgers, M. E. McKevitt, D. O. Hammerlund, K. L. Dickson, and J. Cairns.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 283-301 p, 4 fig, 6 tab, 48 ref.

Descriptors: *Aquatic environment, *Lotic environment, *Primary productivity, Productivity, Macrophytes, Ecosystems, Niutrients, Submerged plants, Emergent plants.

Relatively little attention has been given to investigating the dynamics and functions of macrophytes in lotic systems. This paper presents studies comparing production and relative importance of submerged and emergent macrophytes of the New River, Virginia, and Watauga River, Tennessee. Primary production and decomposition rates of macrophytes were estimated by removing sequential standing crop and measuring weight lost over time from in situ litter-bag incubations of plant materials. Standing crops ranged from 790.1 g/sq m ash free dry weight for Typha latifolia to 9.8 g/sq m for Potamogeton crispus in the New River. In the Watauga River, the maximal standing drops of P. crispus and Podostemum ceratophyllum were 86.8 and 97.6 g/sq m, respectively. The maximal standing crop of P. ceratophyllum in the New River was 12.8 g/sq m. Examination of decomposition rates revealed two apparent categories: fast (k=0.12 - 0.21 g/g/day) and slow (k=0.03 0.04 g/g/day). Comparisons of these rates with those reported for allochthonous inputs can further clarify the role of macrophytes in lotic ecosystems. (Haltermann-PTT)
W86-03389

BIOTIC INTERACTIONS OR ABIOTIC LIMITATIONS. A MODEL OF LOTIC COMMUNITY STRUCTURE,
Cornell Univ., Ithaca, NY. Dept. of Entomology.
B. L. Peckarsky.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 303-323 p, 6 fig, 3 tab, 38 ref.

Descriptors: *Aquatic environment, *Lotic environment, Stream biota, Aquatic communities, Model studies, Competition, Invertebrates, Consumers, Aquatic habitats, Habitats.

The relative roles of biological interactions and physical-chemical factors in structuring benthic stream communities have not been established. If streams are placed on a gradient from harsh to benign physical conditions, harsher streams may be characterized by unfavorable ranges of diel and seasonal fluctuation of such factors as current, depth, substrate shifts, temperature, and availability of habitable space. Biological interactions may be relatively unimportant if harsh physical conditions eliminate predators and maintain prey populations at low numbers. As streams become more benign, biological interactions may increase in importance. Predation may override competition in benign streams where predators are not excluded by physical conditions, where prey have effective

defenses or where prey cannot find spatial refuge from predators. Competition may dominate as a determinate of species distribution within prey refuges, in systems where prey defenses are effective, or within moderately harsh systems where predator populations do not reach levels high enough to exert sufficient pressure on prey populations. (Author)
W86-03390

INTERMEDIATE-DISTURBANCE HYPOTHESIS: AN EXPLANATION FOR BIOTIC DIVERSITY PATTERNS IN LOTIC ECOSYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
J. W. Ward, and J. A. Stanford.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. 347-356 p, 2 fig, 35 ref.

Descriptors: *Aquatic ecosystems, *Lotic environment, Species diversity, Ecology, Species composition, Species density, Stream biota, Biological communities, Model studies.

The intermediate-disturbance hypothesis predicts that biotic diversity will be greatest in communities subjected to moderate levels of disturbance. It is consistent with diversity patterns observed in natural and altered lotic ecosystems. Species diversity is suppressed in stream habitats exposed to disturbances that are severe (organic loading or acid mine drainage) or frequent (diel flow fluctuations). In addition, habitats with enhanced environmental constancy (spring sources or streams below storage reservoirs) exhibit suppressed diversity even if adverse conditions (e.g., oxygen deficits) are not apparent. It is postulated that 'undisturbed' lotic systems are in fact 'disturbed' and that the high biotic diversity of natural streams is a function of moderate perturbation. Diversity is enhanced by the spatio-temporal heterogenity resulting from intermediate disturbance, which maintains the community in a nonequilibrium state. This theory may account for much of the diversity variance within stream systems and between different types of lotic habitats. (Author)
W86-03391

DYNAMICS OF LEAF PROCESSING IN A MEDIUM-SIZED RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
R. W. Paul, E. F. Benfield, and J. Cairns.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983. p 402-423, 3 fig, 3 tab, 58 ref. CNE-(40-1)-4939.

Descriptors: *Aquatic environment, *Lotic environment, *Microbial studies, Particulate organic matter, Detritus, Litter, Particulate matter, New River, Virginia, Cycling nutrients.

Leaf processing in the middle reaches of the New River, Virginia, proceeds at rates equivalent to those reported for small streams. The initial stages of New River leaf processing are mediated by microorganisms and enhanced by mechanical fragmentation, but macroinvertebrates important in initial leaf processing in small streams are unimportant in the section of New River studied. Sycamore(Platanus occidentalis) leaves decomposed at a significantly slower rate than did those of box elder(Acer negundo). Differences in processing rates were caused by differences in initial proportions and distributions of leaf chemical constituents and the rapidity of chemical constituent loss during incubation. Microbial numbers were greater and microbial activity higher on box elder leaves in comparison with sycamore; this was probably because the faster decomposing leaves were favored as a nutritional substrate. Seasonal reductions in chemical constituent losses, microbial activity, and processing rates occurred during winter. In spring, leaf chemical losses, microbial activity, and processing rates gradually increased; this suggests that seasonal temperature regulated all processing mechanisms studied. (Author)
W86-03393

ROLE OF SHREDDERS IN DETRITAL DYNAMICS OF PERMANENT AND TEMPORARY STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. M. Kirby, J. R. Webster, and E. F. Benfield.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983, 425-435 p, 4 fig, 2 tab, 3 ref.

Descriptors: *Aquatic environment, *Lotic environment, *Microbial studies, Invertebrates, Particulate organic matter, Detritus, Litter, Particulate matter, Guys Run, Virginia.

Leaves form the major trophic base of many streams, especially small headwater streams draining forested watersheds in the eastern deciduous forest of North America. Leaves entering these streams are broken down by a combination of physical, chemical, and biological factors, including mechanical breakage, leaching of water-soluble compounds, microbial decomposition, and invertebrate feeding. The concern of this report is the importance of invertebrate feeding on leaf breakdown rates and generation of small particles of detritus. It has been suggested that leaf-shredding insects have an important role in breakdown of leaf detritus and the production of particulate organic matter (POM) in streams. This role was evaluated by comparing detrital dynamics in three permanent and three temporary tributaries of Guys Run, Rockbridge County, Virginia. In general, the streams with fastest leaf breakdown, highest low-flow POM concentrations, and largest average POM particulate sizes were found to have the greatest shredder and total insect densities. It was concluded that this is further evidence for the importance of shredders in woodland streams.
W86-03394

MICROBIAL ACTION IN DETRITAL LEAF PROCESSING AND THE EFFECTS OF CHEMICAL PERTURBATION,
Columbia National Fisheries Research Lab., MO.
J. F. Fairchild, T. P. Boyle, E. Robinson-Wilson, and J. R. Jones.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983, 437-456 p, 11 fig, 27 ref.

Descriptors: *Aquatic environment, *Lotic environment, *Microbial studies, Detritus, Cycling nutrients, Organic carbon, Aquatic communities, Sodium penta-chlorophenol, Adenosine triphosphate, Lipid synthesis, Electron microscopy.

A laboratory study was conducted to determine the effects of microbial action on detrital leaf processing and to quantify the effects of an anti-microbial agent on our microbial functions. Preleached disks from leaves of Acer saccharum were incubated in flasks of stream water on a rotary shaker at 20 degree C for 56 days. Treatments consisted of a control, killed control, and 1.0 and 10.0 mg/l sodium pentachlorophenol(PCL). Leaf disks were periodically measured for changes in dry weight, ask weight, ash-free dry weight(AFDW), and nitrogen. Microbial measurements included respiration, adenosine triphosphate, and 14C acetate incorporation in lipids. Changes in AFDW of leaf disks in the control indicated that microbes processed 21% of leaf material during the 56-day study. The PCP treatments did not differ significantly from the control in loss of AFDW from leaf disks. Significant differences were noted among several microbial characteristics, however, this possibly indicates structural differences caused by the PCP treatments. Chemical perturbation could alter the structure of microbial communities and therefore adversely affect leaf processing, invertebrate productivity, and fishery resources. (Author)
W86-03395

CHARACTERIZATION OF THE KINETICS OF 'DENITRIFICATION' IN STREAM SEDIMENTS,
Guelph Univ. (Ontario).
W. N. Stammers, J. B. Robinson, H. R. Whiteley, and N. K. Kaushik.
IN: Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI. 1983, 479-486 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Kinetics of denitrification, *Denitrification, Sediments, Nitrogen removal, Model studies, Nitrates, Sinks.

Inferences have been drawn from experiments, involving sediment columns with supernatant nitrate solutions, on the kinetic nature of the denitrification process which occurs in stream sediments. Work reported in this paper examines the utility of continuous and lumped models of nitrate transport as bases for the investigation of both transient and steady-state responses to pulse and constant supernatant nitrate solutions input concentrations to sediment columns. The measured system output was supernatant nitrate concentration in the case of the pulse input and nitrate flux into the sediment in the case of the constant supernatant nitrate solution concentration. The transient response in all cases was found to be inappropriate for the investigation of denitrification process kinetics. However, the steady-state response to a constant supernatant nitrate solution concentration was found appropriate for testing hypotheses about process kinetics using both lumped and continuous transport models. Results indicate that the denitrification process may be kinetically described as a zero-order process. (Author)
W86-03397

KILLING RAIN: THE GLOBAL THREAT OF ACID PRECIPITATION,
For primary bibliographic entry see Field 5B.
W86-03416

5D. Waste Treatment Processes

DISSOLVED-OXYGEN REGIME OF THE JORDAN RIVER, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03011

WASTEWATER AND SLUDGE CONTROL-TECHNOLOGY OPTIONS FOR SYNFUELS INDUSTRIES; VOL. 2: TAR-SAND-COMBUSTION PROCESS WATER -- REMOVAL OF ORGANIC CONSTITUENTS BY ACTIVATED-SLUDGE TREATMENT,
Argonne National Lab., IL. Energy and Environmental Systems Div.
M. F. Torpy, L. A. Raphaelian, and R. G. Luthy.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-017656, Price codes: A04 in paper copy, A01 in microfiche. ANL/ES-115, Vol. 2, November 1981. 53 p, 8 fig, 12 tab, 23 ref, 3 append. W-31-109-Eng-38.

Descriptors: *Wastewater treatment, *Wastewater analysis, Activated sludge, Chemical oxygen demand, Oxygen demand, Wastewater, Chemical sludge, Sludge, Organic carbon.

Gas-chromatography/mass spectrometry analysis of raw process water from reverse-forward combustion in a tar sand extraction experiment indicated that identifiable compounds were distributed in about equal portions among acid, base, and neutral fractions. The compounds in the neutral fraction were unsaturated, oxygenated methyl cyclohexenyl ketones, methyl-methylcyclohexenyl ketones, acetophenones including methyl-tolyl ketones, lactones, and indanones. Neutral fraction constituents were reduced by about 99% during activated-sludge treatment. The base fraction consisted of pyridines, quinolines and their alkane substitutes, and acridines. These compounds were reduced by about 76% during treatment. The acid fraction consisted of carboxylic acids ranging in molecular weight from C1 to C11, phenols and cresols, and benzoic and toluic acids. These materials were reduced by about 95% through activated-sludge treatment. It was concluded that (1) activated-sludge treatment can reduce soluble organic carbon and chemical oxygen demand by about

90% in the process water and (2) the water is nonmutagenic as defined by the standard Salmonella/Ames test. (Author)
W86-03232

REMOVAL OF TOXIC METALS IN ELECTROPLATING WASH WATER BY A DONNAN DIALYSIS PROCESS,
Southwest Research Inst., San Antonio, TX.
H. F. Hamil.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-148155, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/2-82-098, December 1982. 31 p, 2 fig, 12 tab, 7 ref, 1 append. CR807476.

Descriptors: *Separation techniques, *Donnan process, *Heavy metals, *Industrial wastewater, *Electroplating, *Anion exchange, Cadmium, Copper, Zinc, *Ion exchange, Wastewater treatment, *Membrane processes, Anions, Metal-finishing wastes, Metals, Cyanide, *Dialysis.

A program was conducted to develop anion-exchange membranes to be used in the removal of Cu, Cd, and Zn, as their cyanide anions, from cyanide process electroplating wash waters by a Donnan dialysis process. For these laboratory studies, simulated wash waters prepared by diluting electroplating bath solutions to the desired metal content were utilized. Series of anion-exchange membranes based on radiation grafted polyethylene films were prepared. The grafting monomers used were vinylpyridines or vinylbenzylchloride. These grafted membranes were converted to anion-exchange membranes by quaternization with alkyl halides or trialkylamines, respectively. The series of membranes exhibited varying ion-exchange capacities and varying hydrophilicity. Evaluation of the membranes in Donnan dialysis showed that ion transport rates are directly proportional to ion-exchange capacity. Previous studies have shown that the effect of membrane hydrophilicity is more complex; very low hydrophilicity leads to zero ion transport. Moderate hydrophilicity gives membranes with good transport properties. Very high hydrophilicity leads to membranes with very low ion selectivity. Cation leakage becomes excessive and reduces the potential for anion selective transport. (Author)
W86-03239

REVISED SECTION 301 (H) TECHNICAL SUPPORT DOCUMENT,
Tetra Tech, Inc., Bellevue, WA.
For primary bibliographic entry see Field 6E.
W86-03259

MONITORING AND ANALYSIS OF HAZARDOUS ORGANICS IN MUNICIPAL WASTEWATER - A STUDY OF TWENTY-FIVE TREATMENT PLANTS,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W86-03262

BENCH-SCALE TREATMENT OF COAL LIQUEFACTION PROCESS WASTEWATERS,
Oak Ridge National Lab., TN.
W. D. Bostick, R. L. Jolley, J. D. Hewitt, and J. B. Overton.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83000468, Price codes: A03 in paper copy, A01 in microfiche. ORNL/TM-8408, September 1982, 45 p, 7 fig, 11 tab, 31 ref, 2 append.

Descriptors: *Wastewater treatment, *Coal liquification process, Chemical composition, Chemical treatment, Solvent extraction, Ozonation water treatment, Adsorption, Activated carbon.

Coal conversion wastewaters present unusual control technology problems due to their high concentrations of certain toxic chemicals such as phenolics, ammonia, and sulfide ion. The most contaminated wastewater streams are the process condensates or sourwaters that have been in direct contact with organic species at high temperature during the conversion process. Treatment of these process condensates to meet present and projected discharge limits is thus a formidable challenge. The specific effects of the bench-scale treatment of a sample of process condensate from the H-coal liquification process pilot plant located at Catlettsburg, Kentucky, are presented. The unit operations used were: stream-stripping to remove ammonia and sulfide ion; solvent-extraction with methyl isobutyl ketone to remove phenolic compounds and neutral organics; and ozonation and carbon adsorption as 'polishing' steps. Some of the advantages and limitations of these operations are reported. (Halterman-PTT)
W86-03267

WASTEWATER APPLICATIONS IN FOREST ECOSYSTEMS,
Cold Regions Research and Engineering Lab., Hanover, NH.
H. L. McKim, W. E. Supper, D. Cole, W. Nutter, and D. Urie.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A119994, Price codes: A02 in paper copy, A01 in microfiche. CRREL Report 82-19. August 1982. 22 p, 9 fig, 19 tab, 39 ref.

Descriptors: *Wastewater treatment, *Municipal wastewater, *Forests, Chlorination, Buffer zones, Bioaccumulation, *Land disposal, Trees.

The purpose of this report is to summarize the current state of knowledge relating to the application of municipal wastewater in forest ecosystems and to assist in the design of such systems. This report will supplement the Process Design Manual for Land Treatment of Municipal Wastes, EM 1110-1-501. The data in this report covers three forest regions 1)Western forest ecosystems (Douglas fir, Poplar), 2)Eastern forest systems (mixed hardwoods, red pine, white spruce and others), and 3)Southern yellow pine ecosystems. Necessary pretreatment is minimal; Chlorination should be avoided as residual chlorine and chlorinated organics reduce the ability of the trees to assimilate nutrients. Narrower buffer zones are needed due to lower sprinkler pressures, the generally confined areal distribution in forests, and the physical barrier provided by the trees. Wastewater application to immature, but not mature, trees significantly increases the diameter and height of the trees.
W86-03295

TREATMENT TECHNOLOGY FOR REMOVAL OF DISSOLVED GASOLINE COMPONENTS FROM GROUND WATER,
IT Corp., Knoxville, TN.
Final Report, Vol 1, D87-API, American Petroleum Institute, Washington, DC, May 13, 1983. 201 p, 10 fig, 6 tab, 5 app, 5 ref.

Descriptors: *Water treatment, *Activated carbon, *Air stripping, *Gasoline, Benzene, Toluene, Xylene, Ethylbenzene, Methyl t-butyl ether, t-Butyl alcohol, Groundwater, Organic compounds, Cost, Oil industry.

Laboratory evaluations of activated carbon adsorption and air stripping of groundwater containing dissolved gasoline were conducted to identify optimum design conditions. These were then used to develop capital and operating cost estimates for full-scale treatment systems. Activated carbon adsorption was evaluated in the laboratory in a 1-in. diameter miniplant column and a 1/4-in. diameter microcolumn. The activated carbon adsorption technology was very effective in removing the aromatic compounds from water (e.g., benzene, toluene, xylene, ethylbenzene), but was relatively ineffective in removing the oxygenates. A hydraulic loading of 2 gpm/sq. ft. resulted in slightly better carbon loading performance than 7 gpm/sq. ft. and 6 ft. of carbon provided a better staging efficiency and superior column performance than 3 ft. A curve of loading capacity vs feed concentration was generated based on the experimental results. Air stripping was evaluated in the laboratory using a 1 1/2-in. diameter column packed with 1/4-in. berl saddles. The air stripping technology was very effective in removing all compounds from the water except t-Butylalcohol. Remove efficiency did not appear to be a function of either composition of influent concentration over the range investigated. Increasing air/water ratio improved removal efficiency and lower water temperature resulted in decreased removal efficiencies. At relatively low contaminant concentrations (<10 ppm), carbon adsorption and air stripping are comparable in treatment cost; but as concentration increases, air stripping gains a cost advantage.
W86-03311

PRETREATMENT AND BIOLOGICAL DIGESTION OF METC (MORGANTOWN ENERGY TECHNOLOGY CENTER) STIRRED FIXED BED GAS PRODUCER WASTEWATERS,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. D. Neufeld, C. Moretti, F. Ali, and J. Paladino.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-004748, Price codes: A08 in paper copy, A01 in microfiche. Final Report, Dept. of Energy, Morgantown, WV. Morgantown Technology Center. September 30, 1981. 173 p, 24 fig, 14 tab, 4 app, 24 ref. DE/AC2180MC14372.

Descriptors: *Coal gasification, *Ammonia stripping, *Biological treatment, *Activated sludge, Water, Pollution control, Gasification, Ozonation, Phenols, Sludges, Bulking sludge, Flocculation.

Wastewater was pretreated by a series of operations which included one stage cold or two stage hot ammonia stripping, pH adjustment followed by chemical coagulation and flocculation, and aerobic biological processing at 1 day detention time. The overall objective of research was to document and demonstrate the capabilities of a properly designed aerobic biological system for the stable treatment of fixed bed gas producer wastewaters. A comprehensive flow sheet design based upon laboratory derived parameters is included for the treatment of gas producer wastewaters. For tertiary treatment, preliminary data is presented on the ozonation of pretreated and biologically treated gasifier wastewaters both with and without the use of activated carbon. Preliminary chemical data is also presented from gas chromatography/mass spectroscopy determinations of acid and base extractable portions of wastewaters at various sampling locations within the pretreatment and biological treatment scheme. When the feed strength of the gasifier wastewater was >30%, several problems occurred. The oxygen supply was depleted in the laboratory sized facility, and foaming, bulking sludge and sludge deflocculation were problems in the pilot facility. Foaming could be prevented by a combination of continuous feeding of an anti-foaming agent and by making sure that the ammonia-stripping gave an influent ammonia concentration of 200 mg/L. A combintion of alum and lower strength wastewater curtailed filamentous bacteria growth, thereby inhibiting bulking sludge. Sludge deflocculation is the major limiting criterion in minimalization of dilution water, and is controlled by carefully controlling the concentration of non-biodegradable materials in the influent stream.
W86-03318

5E. Ultimate Disposal Of Wastes

WASTEWATER APPLICATION BY SPRAY IRRIGATION ON A FIELD SOUTHEAST OF TALLAHASSEE, FLORIDA: EFFECTS ON GROUND-WATER QUALITY AND QUANTITY, 1980-82,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02929

RECONNAISSANCE OF WATER QUALITY AT A U.S. DEPARTMENT OF ENERGY SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02930

DESCRIPTION OF AQUIFER UNITS IN WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02950

CONCEPTUAL HYDROLOGIC MODEL OF FLOW IN THE UNSATURATED ZONE, YUCCA MOUNTAIN, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02974

DESCRIPTION AND SOME HYDROGEOLOGIC IMPLICATIONS OF CORES FROM THE RADIOACTIVE WASTE MANAGEMENT COMPLEX, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
C. T. Rightmire.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4071, 1984. 51 p, 14 fig, 8 tab, 9 ref.

Descriptors: *Core analyses, *Radioactive waste burial ground, *Idaho, *Petrographic analyses, Interbedded sedimentary units, Fracture filling, Radioactive Waste Management Complex, Idaho National Engineering Laboratory, *Hydrogeology.

Samples of sedimentary material from interbeds between basalt flows and from fractures in the flows, taken from two drill cores at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory were analyzed for (1) particle-size dribution, (2) bulk mineralogy, (3) clay mineralogy, (4) cation-exchange capacity, and (5) carbonate content. Thin sections of selected sediment material were made for petrographic examination. Preliminary interpretations indicate that (1) it may be possible to distinguish the various sediment interbeds on the basis of their mineralogy, (2) the presence of carbonate horizons in sedimentary interbeds may be utilized to approximate the time of exposure and the climate while the surface was exposed (which affected the hydrogeologic character of the sediment), and the type and orientation of fracture-filling material may be utilized to determine the mechanism by which fractures were filled. (USGS)
W86-02999

WATER-QUALITY DATA FOR 34 SITES, APRIL AND JUNE, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03048

MEASUREMENT OF GROUND-WATER VELOCITY USING RHODAMINE WT DYE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03051

REVIEW OF BURIED CRYSTALLINE ROCKS OF EASTERN STATES IN SELECTED HYDROGEOLOGIC ENVIRONMENTS POTENTIALLY SUITABLE FOR ISOLATING HIGH-LEVEL RADIOACTIVE WASTES,
Geological Survey, Louisville, KY. Water Resources Div.
R. W. Davis.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4091, 1984. 20 p, 6 fig, 34 ref.

Descriptors: *Radioactive waste disposal, *Nuclear wastes, *Saline water, Groundwater barriers, Crystalline rocks, *Cincinnati Arch Area, *North Carolina, Eastern US, Atlantic Coastal Plain.

Among the concepts suggested for the deep disposal of high-level radioactive wastes from nuclear power reactors is the excavation of a repository in suitable crystalline rocks overlain by a thick sequence of sedimentary strata in a hydrogeologic environment that would effectively impede waste transport. To determine the occurrence of such environments in the Eastern United States, a review was made of available sources of published or unpublished information, using the following hydrogeologic criteria: (1) the top of the crystalline basement rock is 1,000 to 4,000 feet below land surface; (2) the crystalline rock is overlain by sedimentary rock whose lowermost part, at least, contains groundwater with a dissolved-solids concentration of 10,000 milligrams per liter or more; (3) shale and or clay confining beds overlie the saline-water aquifer; and (4) the flow system in the saline-water aquifer is known or determinable from presently available data. All of these hydrogeologic conditions occur in two general areas: (1) parts of Indiana, Ohio, and Kentucky, underlain by part of the geologic structure known as the Cincinnati arch, and (2) parts of the Atlantic Coastal Plain from Georgia to New Jersey. (USGS)
W86-03127

REPORT ON LONG ISLAND SOUND DREDGED MATERIAL CONTAINMENT STUDY WORKSHOP PROJECT,
Long Island Sound Task Force, Stamford, CT.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-122607, Price codes: A07 in paper copy, A01 in microfiche. Final Report, Workshop Digest, 18-21 May 1981. 141 p, 1 append. DACW3381-M-0479.

Descriptors: *Dredging, *Ocean dumping, Ecosystems, Aquatic environment, Environment, Aquatic habitats, Marine environment, Marine sediments, Legal aspects, Legislation.

A compilation of papers from four public workshops on disposal of dredged materials in coastal containment facilities in the Long Island Sound, is presented. Major categories of information include: summaries of workshops held in New London, New Haven, and Stamford, Connecticut, and in Great Neck, New York; official statements and written communications from area legislators; composite narrative accounts of the workshops; a compilation of unresolved issues; a public information program; and media coverage generated by the workshop project. (Halterman-PTT)
W86-03270

SLUDGE - RECYCLING FOR AGRICULTURAL USE,
Environmental Protection Agency, Washington, DC. Office of Water Program Operations.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-164202, Price codes: A02 in paper copy, A01 in microfiche. 430-9-82-008, October 1982. 17 p.

Descriptors: *Sludge utilization, *Land disposal, *Land application, *Recycling, *Sludge disposal, Sludge digestion, Digested sludge, Sludge conditioning, Fertilizers, Municipal wastes, Solid waste disposal, Waste disposal, Soil amendments.

This brochure was prepared as one of a series of reports to supply data on current practices that are emphasized by the Clean Water Act involving the utilization and recycling of municipal effluents and sludges. It provides insight into how several communities have successfully developed sludge management programs that involved the recycling of municipal sludge for agricultural use. Sludge is the residue of materials removed from wastewater treatment that was traditionally disposed of by ocean dumping, landfilling, or incineration. The benefits of recycling municipal sludges for agricultural use are extensive. Sludge stabilization is essential before land disposal to achieve destruction of pathogens. Public education programs are also needed to assure community acceptance of sludge disposal practices. In Salem, Oregon, sludge disposal is handled through the BIOGRO Program in which sludge is applied as fertilizer to agricultural lands. In Madison, Wisconsin, stabilized sludge is applied to farmland under the METROGRO Program. In Rickmansworth, Great Britain, sludge is marketed to farmers under the name of HYDIG. In Los Angeles County, California, sludge solids are composted after stabilization by digestion, and the compost thus produced is sold to a local fertilizer company that further processes the material through screening and blending. The operating and performance features of sludge reuse and the future prospects for sludge recycling programs are discussed. (Geiger-PTT)
W86-03275

SELECTED HYDROLOGIC AND GEOCHEMICAL ISSUES IN SITE CHARACTERIZATION FOR NUCLEAR WASTE DISPOSAL: FLOOD BASALTS AT THE HANFORD RESERVATION,
California Univ., Berkeley. Lawrence Berkeley Lab.
C. L. Carnahan, J. M. Delany, J. C. S. Long, R. J. Silva, and D. J. Watkins.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2983, Price codes: A08 in paper copy, A01 in microfiche. NUREG/CR-2983, LBL-15029, January 1983. 165 p, 22 fig, 2 tab, 130 ref, 4 append.

Descriptors: *Groundwater pollution, *Fate of pollutants, *Radioactive waste disposal, *Basalts, *Waste management, Groundwater movement, Numerical analysis, Models, Model studies, Mathematical models, Mathematical studies, Evaluation, Geochemistry, Waste dumps, Site selection, Radiactive wastes.

Four issues are considered that must be addressed by a site characterization program designed to evaluate the suitability of the flood basalts of the Pasco Basin in central Washington as a site for the construction of a repository for the disposal of high-level nuclear waste. The four issues are: identification of hydrostratigraphic units within a sequence of flood basalts, mechanisms and points of groundwater recharge and discharge, solubility of radionuclides, and phase transformation of fracture filling materials. Each issue is discussed in terms of its significance to waste isolation. Available approaches for resolving the issues are presented and their limitations identified. Where appropriate, research programs for overcoming these limitations are indicated. Basic data needed for identifying areas and mechanisms of groundwater recharge and discharge include bedrock geometry, hydraulic properties, initial conditions, and boundary conditions. Standard approaches used to acquire data include water budget, numerical analysis, and direct synthesis techniques. The identities and solubilities of compounds formed by radionuclides will depend on the oxidation states of the radionuclides, the redox properties of the groundwater and surrounding rock, and the nature and concentration of precipitating ions and complexing ligands in the groundwater system. A complete chemical characterization of down-hole samples of groundwater is necessary to detect radionuclide contaminants in groundwater. (Geiger-PTT)
W86-03282

COSTS OF ENVIRONMENTAL QUALITY TO THE WATER INDUSTRY,
Thames Water Authority, London (England).
W. R. Harper, and J. Moss.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd., Chichester, England, 1984. p 258-266, 8 ref.

Descriptors: *Environmental protection, *Drinking water, Potable water, Sewage sludge, Sewage treatment, Water quality standards, Hazards, Wastewater facilities, Environmental quality.

The costs associated with water related environmental quality is an important issue for those groups thus involved. The purpose of this paper is to identify costs to the water industry associated with water-related environmental quality, and to examine the recent economic background against which these costs have been incurred. Various aspects of possible chances in cost patterns are also discussed. Some costs associated with water qual-

ity-related activities, including improvement of potable supply rivers, estuarial waters and beaches, totaled 681.9 million pounds in 1982/1983. Future cost changes are predicted to arise from three main influences: the increasing recognition of the need for conservation of resources, sustained pressure to secure improved efficiency and effectiveness in public authority spending, and, finally, increasing stringency in externally imposed environmental quality standards. (Halterman-PTT)
W86-03360

5F. Water Treatment and Quality Alteration

QUALITY OF GROUND WATER USED FOR PUBLIC SUPPLY IN FLORIDA, 1983-84,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W86-02986

TOXIC SUBSTANCES IN SURFACE WATERS OF THE B. EVERETT JORDAN LAKE WATERSHED.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5B.
W86-03132

REMOVAL OF VOLATILE ORGANIC CONTAMINANTS FROM GROUND WATER,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
G. G. Robeck, and O. T. Love.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-168617, Price codes: A02 in paper copy, A01 in microfiche. EPA-600/D-83-011, February 1983. 20 p, 7 fig, 1 tab, 30 ref.

Descriptors: *Aeration, *Organic compounds, *Groundwater pollution, *Activated carbon, *Adsorption, Water quality control, Water pollution control, Organic solvents, Filtration, Oxidation, Ozonation, Chlorination, Coagulation, Corrosion, Water treatment.

Because groundwater is a source of potable water for millions of people, an ecological means of removing volatile organic contaminants in essential. Laboratory, pilot-scale and full-scale studies are being carried out in the United States to determine the effect of various treatment processes on the removal of volatile organics from groundwater. To choose the most cost-effective treatment scheme, the organic quality of the raw water must be thoroughly characterized, the organic quality of the treated water must be decided, and the solution must not substitute the organic problem for microbiological or inorganic deterioration, or increased corrosion potential in the distribution system. Coagulation, sedimentation, precipitative softening, filtration, and chlorination are ineffective for reducing concentrations of trichloroethylene and related industrial solvents. Aeration, adsorption on granular activated carbon, or a combination of these processes are being used to remove volatile organic contaminants from groundwater. Preliminary findings using diffused-air, packed-tower, redwood slat, and spray aerators, and air lift pumps are discussed. Home treatment adsorption units are being studied for use in emergency situations or in area where a central treatment system is not feasible. Packed tower aeration is the least expensive alternative for the removal of volatile organic compounds. Aerator exhaust may have to be controlled by passage through an adsorbent. (Geiger-PTT)
W86-03254

EVALUATION OF THE ADSORPTION PROPERTIES OF SILICALITE FOR POTENTIAL APPLICATION TO ISOLATING POLAR LOW-MOLECULAR-WEIGHT ORGANICS FROM DRINKING WATER,
Ames Lab., IA.
C. D. Chriswell, D. T. Gjerde, G. Shultz-Sibbel, J. S. Fritz, and I. Ogawa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-149502, Price codes: A02 in paper copy, A01 in microfiche. EPA-600/1-83-001, January 1983, 23 p, 1 fig, 7 tab, 14 ref.

Descriptors: *Organic compounds, *Drinking water, *Separation techniques, *Pollutant identification, *Adsorbents, Water analysis, Adsorption, Reverse osmosis.

Because of their high affinity for water, low-molecular weight polar organic compounds are difficult to isolate from drinking water as a prelude to their identification and determination. Conventional isolation techniques such as solvent extraction, absorption, gas purging and reverse osmosis yield only low recoveries when applied to small molecules with water-like chemical and physical properties. In this work the chemical and physical properties of the adsorbent known as Silicalite were explored, the characteristics of the molecular sieve for accumulating analytes from aqueous and from gaseous streams were elucidated, techniques were developed for recovering absorbed organic materials from the molecular sieve adsorbent, and an analytical protocol was developed for determining low-molecular weight analytes such as dichloroacetonitrile in standard samples. Accumulated organic materials were recovered from the molecular sieve by a simple, convenient and effective elution technique using a water-methanol gradient as the eluent. When adsorption and recovery procedures were combined to form an isolation protocol, it was found that compounds as diverse as phenol, acetic acid, ethyl acetate, chloroform, crotonaldehyde, propanal, acetaldehyde and butanol could be recovered from standard solutions in amounts in excess of 80% of the original concentration. When the procedure was optimized for the determination of dichloroacetonitrile, quantitative recoveries were obtained on standard samples. (Author)
W86-03266

KINETIC MODEL FOR THE CHLORINATION OF POWER PLANT COOLING WATERS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. D. Johnson, and R. G. Qualls.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG/CR-2806, Price codes: A05 in paper copy, A01 in microfiche. NUREG/CR-2806, January 1983. 83 p, 31 fig, 8 tab, 50 ref, 2 append. NRC-04-77-119.

Descriptors: *Cooling water, *Chlorination, *Residual chlorine, *Kinetics, *Water quality control, Powerplants, Condensers, Fouling, Chlorine, Models, Model studies, Humic acids, Fulvic acids, Organic acids, Models, Water treatment.

Kinetic expressions for the short term reactions of chlorine consumption by organic substances in natural freshwater were developed to use in a kinetic model to predict the free and total available chlorine discharged in cooling water from powerplant condensers. This model uses commonly available water quality data and assumes that most of the chlorine consuming substances are NH3, chloramine-forming organics-N, and humic substances. It uses the Morris-Wei model of chlorine-ammonia reactions. Chloramine formation from organic-N was represented by glycylglycine. About 10% of the dissolved organic-N formed chloramines in the river water samples. Isolated fulvic acid was used to model the kinetics of chlorine consumption by humic substances. The humic reactions were adequately described by the sum of two second order reactions. Concentrations of fulvic acid reaction sites were related to fulvic acid C concentration. Rates of chlorine consumption by fulvic acids from three diverse water sources were similar showing the general applicability of the model. Simulations of chlorine consumption in several river water samples matched the measured data reasonably well. Using conditions typical of once-through chlorination, the most important reactions consuming free residual chlorine were NH2Cl formation, and consumption by humic substances in those samples. Most total residual chlorine reduction was caused by humic substances. (Geiger-PTT)
W86-03283

PERFORMANCE CHARACTERISTICS OF PACKAGE WATER TREATMENT PLANTS,
Cincinnati Univ., OH.
J. M. Morand, and M. J. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-161018, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/2-82-101, December 1982. 73 p, 14 fig, 24 tab, 18 ref. CR806449.

Descriptors: *Water quality, *Performance evaluation, *Water treatment facilities, *Water analysis, *Water quality standards, Water treatment, Turbidity, Coliforms, Residual chlorine, Organic compounds, Drinking water, Potable water, Pollutant identification.

This study was undertaken to collect reliable on site information on the quality of treated water produced by package plants. Six plants in operation year round were selected to be representation of those serving small populations, and were monitored to assess their performance. Plants selected used surface water sources. Sampling trips were made over a 2 yr period. At each plant, samples were collected of the raw water, the treated water, and water from the distribution system. Turbidity, total coliform, and chlorine residual data were collected on all visits. Standard plate counts, chemical listed in the US EPA Drinking Water Regulations, and trihalomethanes were determined intermittently. Only one treated water sample, a distribution sample, showed any total coliforms. Sixty-eight percent of the treated water standard plate counts showed densities of 10 or less per milliliter. Three of the plants met the 1 ntu turbidity standard on nearly all occasions. The other three plants were meeting the standard during less than half of the sampling trips. Failure of these plants to perform well is attributed to the variability and quality of their sources and/or to the lack of skilled operators having sufficient time to devote to treatment. (Author)
W86-03285

COSTS OF ENVIRONMENTAL QUALITY TO THE WATER INDUSTRY,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 5E.
W86-03360

5G. Water Quality Control

ESTIMATED PUBLIC-WATER SUPPLY AND INDUSTRIAL-COMMERCIAL WATER WITHDRAWALS AND RETURNS IN NASSAU COUNTY, LONG ISLAND, NEW YORK, 1973-79,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 6D.
W86-02957

DETERMINING THE EFFECTIVENESS OF HIGHWAY DRAINAGE SYSTEMS IN PREVENTING SALT CONTAMINATION OF GROUND WATER,
Geological Survey, Boston, MA. Water Resources Div.
S. J. Pollock.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4166, 1984. 22 p, 10 fig, 1 tab, 6 ref.

Descriptors: *Highway effects, *Environmental effects, *Snow removal, *Salts, Groundwater recharge, Highway icing, Road design, Salt balance, Water quality, Groundwater aquifers, Groundwater movement, Hydrogeology, *Massachusetts, Plymouth, Bourne, Wareham, *Water pollution sources.

A study to determine the relative effectiveness of specially designed highway drainage features in preventing salt contamination of ground water was

designed to compare four different drainage designs along a new highway in Massachusetts. At the control site, no attempt will be made to prevent salt from entering the ground. At the other three sites, different combinations of drains and impermeable berms have been designed to prevent salt contamination of ground water. To evaluate the effectiveness of the drainage designs, a salt balance will be prepared at each site over 5 years of highway use. The amount of salt applied to the highway will be compared to the amounts in the ground water or diverted to the drainage systems. Salt loads in ground water will be determined from sodium and chloride concentrations in water from about 80 wells and from aquifer porosity estimated from geophysical logs and lithologic samples. Salt loads in the drainage systems will be estimated from flow and specific conductance with the use of stage-to-discharge and conductance-to-concentrations rating curves. (USGS)
W86-03044

GEOHYDROLOGY OF TEST WELL USW-H1, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03121

REVIEW OF BURIED CRYSTALLINE ROCKS OF EASTERN STATES IN SELECTED HYDROGEOLOGIC ENVIRONMENTS POTENTIALLY SUITABLE FOR ISOLATING HIGH-LEVEL RADIOACTIVE WASTES,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 5E.
W86-03127

TRIORGANOTIN REGULATIONS IN NORTH CAROLINA.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
Water Quality Section Report, (July 1985). 119 p.

Descriptors: *Water pollution control, *Water quality standards, *North Carolina, *Triorganotin compounds.

A compilation of submittals and staff responses to proposals to establish water quality standards for triorganotins in fresh and saltwater in North Carolina. Portions of a public hearing held on June 27, 1984, are included. Also included are calculations for the numeric water quality standards for triorganotin compounds (0.002 microgram/l in saltwater and 0.008 microgram/l in freshwater). Those values are the first water quality standards for triorganotins and are designed to protect aquatic life from chronic effects of these compounds.
W86-03131

COASTAL DEVELOPMENT AND SHELLFISH WATERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5B.
W86-03133

WATER QUALITY CRITERIA FOR PRIMARY NURSERY AREAS IN NORTH CAROLINA,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5C.
W86-03134

REMOVAL OF VOLATILE ORGANIC CONTAMINANTS FROM GROUND WATER,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5F.
W86-03254

RECLAMATION OF ABANDONED MINED LANDS ALONG THE UPPER ILLINOIS WATERWAY USING DREDGED MATERIAL,
Argonne National Lab., IL. Energy and Environmental Systems Div.
A. Van Luik, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-015024, Price codes: A06 in paper copy, A01 in microfiche. ANL/ES-127, January 1982. 103 p, 17 fig, 22 tab, 27 ref, 1 append.

Descriptors: *Dredging, *Land reclamation, Sediments, *Illinois, Seneca River, Heavy metals, Metals, Pollutants, Legal aspects, Polychlorinated biphenyls.

Sediments were sampled and characterized from 28 actual or proposed maintenance-dredging locations in the Upper Illinois Waterway, that is, the Calumet-Sag Channel, the Des Plaines River downstream of its confluence with the Calumet-Sag Channel, and the Illinois River from the confluence of the Kankakee and Des Plaines Rivers to Havana, Illinois. Sufficient data on chemical constituents and physical properties were obtained to allow the classification of these sediments by currently applicable criteria of the Illinois Environmental Protection Agency for the identification of hazardous, persisted and potentially hazardous wastes. By these criteria, the potential dredged materials studied were not hazardous, persistent, or potentially hazardous; they are a suitable topsoil/reclamation medium. A study of problem abandoned surface-mined land sites ('problem' lands are defined as being acidic and/or sparsely vegetated) along the Illinois River showed that three sites were particularly well suited to the needs of the Corps of Engineers for a dredged material disposal/reclamation site. Reclamation disposal was found to be economically competitive as an alternative to near-source confined disposal for Upper Illinois Waterway dredged material. (Author)
W86-03280

KINETIC MODEL FOR THE CHLORINATION OF POWER PLANT COOLING WATERS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W86-03283

ENVIRONMENTAL PROTECTION: STANDARDS, COMPLIANCE AND COSTS,
For primary bibliographic entry see Field 5B.
W86-03344

POLLUTION CONTROL IN PRACTICE,
North West Water Authority, Warrington (England).
B. Alexander, and E. Harper.
IN: Enviromental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 198-208 p, 7 ref, 2 append.

Descriptors: *Aquatic enviroment, *Environmental protection, Environmental management, Standards, Environmental effects, Europe, United Kingdom, Toxicity, Hazards, Monitoring.

This paper deals with pollution controls as they relate to river pollution where issues such as recreation and amenity are important. It is principally concerned with the practice of pollution control and is, therefore, concerned with how to achieve results in the field. Several elements of successful pollution control that are listed, include identification of the problem, outlining the control option, deciding upon the preferred solution to the problem, and, finally, implementing the preferred solution. Enforcement of criteria includes fines and imprisonment. However, it is pointed out that the best control is actually the prevention of pollution, and several prevention related policies are discussed. The effectiveness of pollution control can best be determined by chemical and biological monitoring of aquatic environments. Although both chemical and biological monitoring techniques are approriate, biological monitoring is the better tool for seeking to prevent pollution. (Halterman-PTT)
W86-03356

SPILLAGES-AN OPERATIONAL APPROACH,
Wessex Water Authority, Bristol (England).
J. A. Young, and R. J. Whitaker.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 209-218 p, 2 fig, 3 ref.

Descriptors: *Aquatic environment, *Environmental protection, Accidents, Hazards, Monitoring, Transportation, Oil spills.

The increasing manufacture, transportation, storage, use and disposal of a wide range of oil and chemical products have made it inevitable that spillages of these materials will occur, and will continue to increase. The primary focus of this paper is the operational approach to responding to spills. One area discussed is the need for contingency planning, including a trained staff and the vehicles and equipment necessary for responding to spill situations. Examples of exercises and training techniques which would help ensure the success of contingency plans are discussed. (Halterman-PTT)
W86-03357

CONTINGENCY PLANNING FOR CHEMICAL ACCIDENTS,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
A. Gilad, and J. I. Waddington.
IN: Environmental Protection: Standards, Compliance and Costs, Ellis Horwood, Ltd, Chichester, England, 1984. 219-233 p, 5 fig.

Descriptors: *Aquatic environment, *Environmental protection, *Accidents, Monitoring, Chemical wastes, Oil spills, Contingency planning.

Toxic and potentially toxic chemicals are now a part of the daily life of most people in the world. Because of the ever-increasing volume of chemicals being manufactured, transported, stored and disposed of as wastes, it is inevitable that accidental spills will happen with increased frequency. The purpose of this paper is to described contingency planning for chemical accidents. First, the response approach should be based on the magnitude of the accident. Levels are categorized from the operator level to the international level. Second, the authors provide suggestions for a systematic approach to the establishment of emergency response systems. The structure and elements of response systems should include an alert system, means of evaluation of the situation and the classification to the accident, and the provision for the flow of information to appropriate groups, including outside help. Finally, the need for protection, and, if necessary, the rehabilitation, of water resources is discussed. (Halterman-PTT)
W86-03358

MODELING THE FATE OF CHEMICALS IN THE AQUATIC ENVIRONMENT.
For primary bibliographic entry see Field 5B.
W86-03417

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PLANNING REPORT FOR THE WESTERN GULF COAST REGIONAL AQUIFER SYSTEM ANALYSIS, GULF OF MEXICO COASTAL PLAIN, UNITED STATES,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03069

HABITAT SUITABILITY INDEX MODELS: LARGEMOUTH BASS,
Fish and Wildlife Service, Fort Collins, CO. West-

ern Energy and Land Use Team.
R. J. Stuber, G. Gebhart, and O. E. Maughan.
FWS/OBS-82/10.16, July 1982. 33 p, 2 fig, 3 tab, 83 ref.

Descriptors: *Habitats, *Aquatic habitats, Environment, Aquatic environment, *Fish, Bass, Model studies, Computer models, Environmental impact statement.

Largemouth bass habitat use information and habitat suitability index (HSI) models, used as an aid for impact assessment and habitat management activities, are discussed. Literature concerning the habitat requirements and preferences of the largemouth bass is reviewed and synthesized into HSI models. Assumptions used to transform habitat use information into these mathematical models are presented, and guidelines for model application are described. The models presented are complex hypotheses of species-habitat relationships. They are, however, not statements of proven cause and effect relationships. (Halterman-PTT)
W86-03244

PLANNING AND MANAGEMENT OF MINE-CUT LAKES AT SURFACE COAL MINES,
Nelson (R. Wayne) and Associates, Inc., Boulder, CO.
R. W. Nelson, J. F. Orsborn, and W. J. Logan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-156422, Price codes: A09 in paper copy, A01 in microfiche. OSM/TR-82/1, May 1982, 199 p, 91 fig, 19 tab, 172 ref, 5 append.

Descriptors: *Strip mine lakes, *Planning, *Management planning, Lake rehabilitation, Economic aspects, Land management, Land use, Ecosystems, Biological samples.

Mine-cut lakes have been constructed in 14 of the 21 states where future (1980-1985) land disturbance from surface coal mining was projected to be at least 1,000 acres. Twelve of the 14 states indicated that mine-cut lakes will probably be constructed in Illinois, Indiana, Kentucky, Tennessee, Alabama, and Oklahoma. Ohio, Pennsylvania, Missouri, Wyoming and Montana indicated that the average annual production of new lakes would be five or less. Texas and Colorado indicated a small future potential as yet undetermined. As an alternative to restoring the pre-mining topography and land use at surface coal mine operations, mine-cut lakes can be planned as a valuable resource for fish and wildlife habitat, recreation, water supply, and allied purposes. The key to productive future use of these permanent water impoundments is careful planning and development of lake and surrounding watershed features aimed at producing physical, chemical and biological characteristics for the intended or potential uses. Many ideas or principles necessary to achieve this goal are presented. (Author)
W86-03245

UPDATE OF TEXAS LAND COVER MAPS BY COMPUTER-ASSISTED ANALYSIS OF LANDSAT DIGITAL DATA: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
For primary bibliographic entry see Field 7B.
W86-03272

COMPUTER BASED MAPPING SYSTEM FOR STORAGE AND RETRIEVAL OF SOIL AND LAND USE DATA: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
For primary bibliographic entry see Field 10D.
W86-03279

6B. Evaluation Process

TOXIC SUBSTANCES IN SURFACE WATERS OF THE B. EVERETT JORDAN LAKE WATERSHED.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5B.
W86-03132

ENVIRONMENTAL COMPLIANCE GUIDE: GUIDANCE MANUAL FOR DEPARTMENT OF ENERGY COMPLIANCE WITH THE FISH AND WILDLIFE COORDINATION ACT.
Department of Energy, Washington, DC. Office of Environmental Compliance.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82022215, Price codes: A02 in paper copy, A01 in microfiche. DOE/EP-0059, July 1982. Volume 3D. 21 p, 2 fig, 5 tab, 25 ref, 1 append.

Descriptors: *Wildlife habitats, *Wildlife conservation, *Water resources development, *Project planning, *Environmental protection, Regulations, Habitats, Wildlife management, Legal aspects, Fisheries, Environmental impact statement, Standards, Aquatic habitats, Fish management, Environmental effects, Management planning, Environmental policy, Ecological effects.

This manual provides guidance for Department of Energy (DOE) officials who are responsible for complying with the Fish and Wildlife Coordination Act (FWCA). The FWCA requires that consideration be given to the conservation of fish and wildlife resources during the development of any DOE projects that affect water resources directly or indirectly. Early in project planning, DOE must cooperate with state and federal wildlife agencies in assessing project impacts to fish and wildlife. The FWCA directs wildlife agencies to make recommendations for mitigation of these impacts and requires DOE to plan its projects in such a way that equal weight is given to wildlife conservation and other project benefits. Since 1974, the Division of Ecological Services of FWS has been developing an assessment system called the Habitat Evaluation procedures (HEP). DOE managers should be aware of the effects the following elements of the HEP considerations have on mitigation recommendations: evalution species selected for impact assessment, the existing habitat value of the various areas affected by DOE project development, and the uniqueness and importance of the habitat types affected by project development on a national or ecoregional level. (Geiger-PTT)
W86-03251

ENVIRONMENTAL COMPLIANCE GUIDE: GUIDANCE MANUAL FOR DEPARTMENT OF ENERGY COMPLIANCE WITH CORPS OF ENGINEERS PERMITS ON DREDGING AND FILLING ACTIVITIES.
Department of Energy, Washington, DC. Office of Environmental Compliance.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82022216, Price codes: A02 in paper copy, A01 in microfiche. DOE/EP-0060, July 1982. Volume 3C. 17 p, 1 fig, 16 ref, 2 append.

Descriptors: *Standards, *Environmental effects, *Project planning, *Dredging, *Fill permits, Regulations, Wildlife habitats, Environmental impact statement, Aquatic habitats, Decision making, Water resources development, Management planning, Environmental policy, Navigable rivers, Navigable waters, Evaluation, Ecological effects.

This document provides general guidance for Department of Energy officials responsible for complying with Sections 9 and 10 of the River and Harbor Act of 1899 and with Section 404 of the Clean Water Act of 1977 (CWA) for issuing permits for dredging or erecting structures on navigable rivers. The Environmental Protection Agency Guidelines require that potential impacts on physical, chemical, and biological properties of the aquatic ecosystem, special aquatic sites, and human use be considered before any project is undertaken. Early planning meetings will establish both the level of existing information and the types of new data needed by DOE to process and review a Section 404 permit application. Guidance is provided in this document on general approaches for collecting, analyzing, and presenting information that addresses both abiotic and biotic impacts. Impacts on physical/chemical characteristics of the discharge site can be considered under the following general categories: substrate effects; suspended particulates/turbidity; water quality; current patterns, water circulation, and water-level fluctuations; and salinity gradients. Potential impacts on ecosystem biota that should be considered area: impacts to aquatic and terrestrial biota; threatened and endangered species; potential impacts on special aquatic sites; and potential impacts on human use. This data will provide the District Engineer with information to predict impacts of the proposed activity and evaluate possible alternatives (Geiger-PTT)
W86-03252

CROP-WATER PRODUCTION FUNCTIONS AND ECONOMIC IMPLICATIONS FOR THE TEXAS HIGH PLAINS REGION,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 3F.
W86-03255

WATER CONSERVATION ALTERNATIVES FOR CALIFORNIA AGRICULTURE: A MICROECONOMIC ANALYSIS,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 3F.
W86-03256

HANDBOOK FOR PROTECTION OF FISH AND WILDLIFE FROM CONSTRUCTION OF FARM AND FOREST ROADS,
Center for Natural Areas, South Gardiner, ME.
J. Hynson, P. Adamus, S. Tibbetts, and R. Darnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-150441, Price codes: A08 in paper copy, A01 in microfiche. FWS/OBS-82/18, July 1982. 152 p, 56 fig, 10 tab, 4 append.

Descriptors: *Best management practices, *Project planning, *Road construction, *Water quality management, *Farms, *Forest watersheds, Planning, Management planning, Decision making, Roads, Wildlife management, Evaluations, Erosion control, Fish.

This Handbook describes 54 best management practices which may be utilized by Federal and State agencies or private landowners and operators in the review of project plants and in the planning, construction, and maintenance of farm and forest roads. Best management practices (BMPs) for planning road and facility layout and design, erosion control, construction and maintenance operations, and restoration to natural conditions, identified through existing State water quality management plans and management practices of Federal agencies, were evaluated as to their environmental, institutional, technical, and economic effectiveness. Based on the results of the evaluation, BMPs were modified or augmented with other practices to enhance their overall effectiveness and to provide for protection and propagation of fish and wildlife resources. A discussion of purpose, description, performance and limitations is provided for each BMP, and an approach is developed which guides Handbook users in the selection of BMPs applicable to site-specific situations. (Author)
W86-03257

PROTECTING INSTREAM FLOWS IN CALIFORNIA: AN ADMINISTRATIVE CASE STUDY,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
S. W. Olive.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-169482, Price codes: A03 in paper copy, A01 in microfiche. Instream Flow Information Paper: No. 14, FWS/OBS-82/34, September 1981. 32 p, 2 fig, 40 ref.

Descriptors: *Decision making, *Water law, *Instream flow, *Case studies, *California, Judicial decisions, Administrative decisions, Water policy, Wildlife management, Environmental policy, Environmental protection, Water management.

This paper describes California water law and the attempts which have been made in the legal and institutional sphere to protect instream uses under that law. The reasons for the way decisions were made in California regarding the question of the protection of instream flows are given. Groups and individuals interested in establishing a system that protects instream flows should analyze the situation in their area before formulating plans. The first step in this analysis is to identify objectives. The second step is to reveal opportunities that permit the achievement of objectives. A careful review should be made of the laws in the area and opportunities sought for public support. The third step involves identifying the agencies and interest groups which will participate in policy formulation regarding instream flow protection. The relative strengths of the participating parties should be assessed so that too much time and effort is not spent trying to meet the needs of a weaker party when a stronger one's needs are ignored. The fourth step is to discover the roles-needs of the various agencies and groups. Using a proposed decision-making scheme, it is possible to ascertain the perceived needs and behavior patterns of the various parties involved and the degree to which a system protecting instream flows would affect those needs. The fifth and final step is the formulation of strategies based on local conditions and the previous four steps. (Geiger-PTT)
W86-03276

ROLE OF NATURAL RESOURCE INVENTORIES IN THE PASSAIC RIVER BASIN, NEW JERSEY,
Passaic River Coalition, Basking Ridge, NJ.
D. F. Leitner.
NSF/RA-800571, March 9, 1981. 152 p, 1 fig, 29 tab, 2 exhibits, 35 ref. OSS7723973.

Descriptors: *Natural resources, *River basins, *Surveys, *New Jersey, Water management, Passaic River Basin, Resources management, Public policy, Planning, Political aspects.

The impact of approximately 30 natural resource inventories (NRI) in the Passaic River Basin in New Jersey were evaluated. The inventories consist of compilations of data pertaining to the natural characteristics of geographic areas as ecological entities. Geology, geography, soils, hydrology, meteorology, vegetation, and wild life are specific components. Existing land use, cultural factors, and historic aspects are considered to provide perspectives on the man-made environment. The report includes descriptions of the NRI process and the Passaic River Basin; a survey of NRI's in the Passaic River Basin; interviews with Federal, state, county, and municipal officials and non-governmental individuals; and specific natural resource entities. The Handbook for Environmental Commissioners (N.J. Department of Environmental Protection, 1976) was used as a guide to recommend components in NRI's. These lists were then compared to the contents of 20 published NRIs from Passaic River Basin municipalities to demonstrate graphically the contents of each inventory. Existing NRI's in the Passaic River Basin have had a limited impact on land use decisions. Politics seem to be a significant factor in the preparation and use of NRI's.
W86-03321

STANDARDS AND LIMITS FOR WATER QUALITY CONTROL,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5C.
W86-03350

MONITORING COMPLIANCE WITH STANDARDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5C.
W86-03351

RIVER WASTE HEAT ASSIMILATION VS. ORGANIC WASTE DISCHARGE,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W86-03381

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-02973

EVALUATION OF THE COST EFFECTIVENESS OF THE 1983 STREAM-GAGING PROGRAM IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02992

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7A.
W86-03073

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN ORLANDO SUBDISTRICT, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03086

LONG-TERM MONITORING OF HABITAT DEVELOPMENT AT UPLAND AND WETLAND DREDGED MATERIAL DISPOSAL SITES, 1974-1982,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
C. J. Newling, and M. C. Landin.
Technical Report D-85-5, July 1985, Final Report. 226 p, 23 fig, 52 tab, 59 ref, 1 append.

Descriptors: *Wildlife habitats, *Dredging, *Environmental effects, *Wetlands, Marshes, Habitats, Vegetation, Plant populations, Comparison studies, Ecological effects.

During the Dredged Material Research Program, six wetland and three upland habitat development projects were established at seven sites to demonstrate the feasibility of creating productive habitat on dredged material deposits. Wetland sites studied were Windmill Point in the James River, Virginia; Buttermilk Sound near the Altamaha River, Georgia; Drake Wilson Island in Apalachicola Bay, Florida; Bolivar Peninsula in Galveston Bay Texas; Salt Pond 3 in South San Francisco Bay, California; and Miller Sands Island in the Columbia River, Oregon. The upland area sites examined included Nott Island in the Connecticut River, Connecticut; Bolivar Peninsula; and Miller Sands. These sites have been monitored since their construction (1975-1977) until 1982. In addition, three natural marsh upland reference sites were selected for comparison to the man-made sites. Results over an 8-yr period show that all of the sites have developed and stabilized, and that they have all been highly successful. Despite a complete lack of management since construction, the sites support plant communities generally comparable to or more productive than those of the reference areas. Wildlife use exceeds that occurring on reference areas, and the sites are compatible with and contributing to the ecosystems of which they are a part. (Geiger-PTT)
W86-03264

6D. Water Demand

MODEL PROJECTIONS, 1980-99, FOR ARKANSAS RIVER VALLEY, HAMILTON AND KEARNY COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-02928

ESTIMATED PUBLIC-WATER SUPPLY AND INDUSTRIAL-COMMERCIAL WATER WITHDRAWALS AND RETURNS IN NASSAU COUNTY, LONG ISLAND, NEW YORK, 1973-79,
Geological Survey, Albany, NY. Water Resources Div.
D. S. Snavely, and J. Williams.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4246, 1985. 16 p, 9 fig, 2 tab, 20 ref.

Descriptors: *Water use, Water users, Groundwater budget, Water conveyance, *Water supply, Wastewater, Sewer systems, Storm sewers, *New York, Nassau County, Long Island, Public-water suppliers.

Nassau County, New York depends upon ground water for its freshwater supply. The primary water uses are for public-water supply and industrial-commercial purposes, which together accounted for 202 Mgal/d (million gallons per day) in 1975. Public-water suppliers withdrew 85 percent of their water from the Magothy Formation. About 133 Mgal/d was returned to the ground after use in 1975, and about 69; Mgal/d was discharged to tidewater. In addition, about 34 Mgal/d infiltrated into sewerlines in 1975 and was also discharged to tidewater. Because of the importance of this freshwater supply, the New York State Department of Environmental conservation reviews applications for the installation of wells and compiles data on pumpage throughout Long Island. It also reviews applications to discharge wastewater into the surface water and ground water of the State. This report summarizes the data filed with the New York State Department of Environmental Conservation for Nassau County during 1973-79. It presents data and estimates on withdrawals for public and industrial-commercial supply, returns to the ground, and discharges through sewer systems. It also includes information on population and land use. (USGS)
W86-02957

POTENTIAL HYDROLOGIC IMPACTS OF A TARSAND INDUSTRY IN 11 SPECIAL TAR SAND AREAS IN EASTERN UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. L. Lindskov.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4109, 1983. 130 p, 26 fig, 34 tab, 70 ref.

Descriptors: *Bituminous materials, *Utah, Water pollution sources, *Colorado River, *Water supply, Hydrology, Environmental effects, Tar sand.

About 93 percent of the Nation's estimated 30 billion barrels of crude oil in tar sand deposits is in 11 tar-sand deposits in eastern Utah that were chosen for leasing by the Federal government. The Tar Sand Triangle area, which contains about 15 billion barrels of oil, is the largest. This area and the Sunnyside and P R Springs areas contain more than three-fourths of the Utah reserves. About 88,000 acre-feet of water per year would be required for a commercial tar-sand industry producing about 365,000 barrels per day. At this rate, most of the recoverable oil would be mined within 30 years. About 22,000 acre-feet of water per year

would be required for a commercial tar-sand industry producing about 83,000 barrels per day. Impacts on local hydrology would be greatest in the Tar Sand Triangle, Sunnyside, and P R Springs areas. Impacts could be minimized with proper construction of surface facilities to decrease erosion, sediment transport, and impoundment of mining and retort water. Increases in salinity of the Colorado River at Imperial Dam, Ariz.-Calif., could be about 3 milligrams per liter, with a peak of 9 milligrams per liter, for a 365,000-barrel-per-day industry and less than 1 milligram per liter, with a peak of 2 milligrams per liter, for an 83,000-barrel-per-day industry. (USGS)
W86-03141

WATER USE IN HAWAII, 1980,
Geological Survey, Honolulu, HI. Water Resources Div.
R. Nakahara.
Hawaii Dept. of Land and Natural Resources, Honolulu, Report R71, 1984. 26 p, 10 fig, 10 tab, 1 ref.

Descriptors: Agricultural use, *Domestic use, Thermoelectric water use, Hydroelectric water use, *Industrial uses, Commercial, *Water utilization, *Hawaii.

Water is a very important natural resource found within a state. In Hawaii, significant quantities of water are withdrawn daily from streams or underground sources for different uses, such as for irrigating crops, raising livestock, providing for human domestic needs, generating hydroelectric power, carrying wastes, cooling, cleaning, and processing food and industrial commodities. This is the second in a series of water-use reports for Hawaii which will enable managers and planners to analyze the various uses and thereby aid them in the sound development and implementation of state water-management plans and programs. Letters and questionnaires were sent to principal water users throughout the State; 94 percent of these questionnaires for 1980 were returned. The remainder has been estimated, based on previous surveys. The 1980 water-use was included as a source of agriculture was the leading water user. When seawater was included as a source of water, industrial-thermoelectric became the major water user. The composite data, resulting from the 1980 survey, are shown in tabular and graphical forms. (USGS)
W86-03170

6E. Water Law and Institutions

TRIORGANOTIN REGULATIONS IN NORTH CAROLINA.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W86-03131

REVISED SECTION 301 (H) TECHNICAL SUPPORT DOCUMENT,
Tetra Tech, Inc., Bellevue, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-153817, Price codes: A11 in paper copy, A01 in microfiche. 430/9-82-011, November 1982. 239 p, 11 fig, 20 tab, 63 ref, 1 append.

Descriptors: *Permits, *Regulations, *Effluent limitations, *Water law, Water quality, *Wastewater treatment, Legal aspects, Water quality standards, Water quality control, Monitoring, Marine environments.

Section 301(h) of the Clean Water Act provides publicly owned wastewater treatment works (POTWs) an opportunity to apply for variances from secondary treatment requirements for discharges to marine waters. This Technical Support Document supplements the section 301(h) regulations as amended in November, 1982. This document provides data which establishes a technical basis for understanding the major differences between the original section 301(h) regulations promulgated in 1979 and the 1982 amended regulations. It also provides a technical explanation of assessments required for obtaining section 301(h) modified discharge permits and guidance for both small and large POTWs to use in completing the appropriate application questionnaire. The assessments described are: physical assessment, water quality assessment, public water supply assessment, recreational activity assessment, biological assessment, toxic substances assessment, and monitoring programs for applicants granted section 301(h) modified discharge permits. A description of the small and large applicant questionnaires is given along with a marine biological assessment, toxic substance control programs, and plan of study for the applicant. (Geiger-PTT)
W86-03259

PROTECTING INSTREAM FLOWS IN CALIFORNIA: AN ADMINISTRATIVE CASE STUDY,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
For primary bibliographic entry see Field 6B.
W86-03276

ASSESSING CULTURAL ATTRIBUTES IN PLANNING WATER RESOURCES PROJECTS.
National Research Council, Washington, DC. Environmental Studies Board.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-113621, Price codes: A02 in paper copy, A01 in microfiche. Report of the Panel on Cultural Attributes in Water Resources Projects, August 30, 1982. 19 p, 2 app.

Descriptors: *Planning, *Water Resources Development, *Archaeology, *Cultural Resources, Historic buildings.

The Panel on Cultural Attributes in Water Resources Projects provided an evaluation of the procedures recommended by the U.S. Water Resources Council (WRC) for assessing the impact of proposed water resources projects on cultural attributes of the affected environment. (Environmental Quality Evaluation Procedures, or EQEP). The EQEP were deemed generally logical and valid. Recommendations were made to assure that the EQEP are consistent with the body of federal legislation dealing with cultural and historical preservation. It was concluded that both historical properties and traditional lifeways are properly considered cultural resources. The EQEP prepared by the MITRE Corporation (1981) for the Corps of Engineers was analyzed. It was concluded that the MITRE analysis was generally a useful elaboration of the EQEP although MITRE defined cultural resources and attributes in ways not consistent with either field use or other federal legislation. The MITRE analysis is more useful at the level of indicators and units of cultural resources although examples of procedures in the MITRE study seemed largely confined to prehistoric archaeology and historic buildings.
W86-03300

ROLE AND ACTIVITIES OF THE OSLO AND PARIS COMMISSIONS,
For primary bibliographic entry see Field 5B.
W86-03352

EUROPEAN COMMUNITY POLICY ON ENVIRONMENTAL MANAGEMENT,
Commission of the European Communities, Brussels (Belgium).
For primary bibliographic entry see Field 5C.
W86-03353

APPROACH OF THE FEDERAL GERMAN REPUBLIC-ANTICIPATING ENVIRONMENTAL EFFECTS,
Council of Experts on Environmental Matters, Bonn (Germany, F.R.).
For primary bibliographic entry see Field 5C.
W86-03354

UK APPROACH - ENVIRONMENTAL QUALITY STANDARDS,
Department of the Environment, London (England).
For primary bibliographic entry see Field 5C.
W86-03355

6F. Nonstructural Alternatives

AUSTIN, TEXAS, FLOOD OF MAY 24-25, 1981,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-03260

6G. Ecologic Impact Of Water Development

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE HORSE CREEK AREA, SHERIDAN AND MOORHEAD COAL FIELDS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02968

PRELIMINARY STUDY USING DIGITAL MODELING TECHNIQUES TO UNDERSTAND AND PREDICT THE TEMPERATURE REGIME IN A STREAM BELOW A MAJOR RESERVOIR–THE NORTH SANITIAM RIVER BELOW DETROIT DAM, OR,
Geological Survey, Portland, OR. Water Resources Div.
A. Laenen, and R. P. Hansen.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4105, 1985. 45 p, 16 fig, 10 tab, 3 ref.

Descriptors: *Stream temperature, *Digital models, *Oregon, Water quality, Dams, Reservoir effects, Lagrangian moving reference frame, North Santiam River, Detroit Dam, Model studies.

A riverine-temperature model and associated data-collection system were developed to help the Corps of engineers determine cost benefits of selective-withdrawal structures for future use with dams on the Willamette River System. A U.S. Geological Survey Lagrangian reference frame, digital computer model was used to simulate stream temperatures on the North Santiam River downstream of the multipurpose Detroit dam and a reregulating dam (Big Cliff), from river mile 45.6 to 2.9. In simulation, only available air-temperature and windspeed information from a nearby National Weather Service station at Salem, Oregon were used. This preliminary investigation found that the model predicted mean daily temperatures to within 0.4 C standard deviation. Analysis of projected selective-withdrawal scenarios showed that the model has the sensitivity to indicate water-temperature changes 42.7 miles downstream on the North Santiam River. (USGS)
W86-03022

IMPACTS OF THE TAMPA BYPASS CANAL SYSTEM ON THE AREAL HYDROLOGY, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03056

SIMULATED EFFECTS OF PROPOSED RESERVOIR-DEVELOPMENT ALTERNATIVES ON STREAMFLOW QUANTITY IN THE WHITE RIVER, COLORADO AND UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03061

HABITAT SUITABILITY INDEX MODELS: LARGEMOUTH BASS,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
For primary bibliographic entry see Field 6A.
W86-03244

ENVIRONMENTAL COMPLIANCE GUIDE: GUIDANCE MANUAL FOR DEPARTMENT OF ENERGY COMPLIANCE WITH THE FISH AND WILDLIFE COORDINATION ACT.
Department of Energy, Washington, DC. Office of Environmental Compliance.
For primary bibliographic entry see Field 6B.
W86-03251

ENVIRONMENTAL COMPLIANCE GUIDE: GUIDANCE MANUAL FOR DEPARTMENT OF ENERGY COMPLIANCE WITH CORPS OF ENGINEERS PERMITS ON DREDGING AND FILLING ACTIVITIES.
Department of Energy, Washington, DC. Office of Environmental Compliance.
For primary bibliographic entry see Field 6B.
W86-03252

WYCOALGAS COAL GASIFICATION PROJECT: PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 1,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5C.
W86-03271

BOSTON MAINTENANCE DREDGING, BOSTON HARBOR, BOSTON, MA: ENVIRONMENTAL ASSESSMENT.
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-120053, Price codes: A04 in paper copy, A01 in microfiche. December 1981. 53 p, 10 tab, 8 fig, 4 app, 61 ref.

Descriptors: *Dredging, *Environmental effects, Turbidity, Harbors, Shoals, Water quality, Bioassay, Aquatic populations, Spoil banks, Mystic River, Boston Harbor, Chelsea River, *Massachusetts.

This Environmental Assessment discusses the need for and the environmental impacts of the proposed maintenance dredging of the Federal navigation channels in the Mystic and Chelsea rivers and the anchorage at President Roads. This action will involve removal of approximately 425,000 cubic yards of harbor sediments for ocean disposal. Major areas of concern include impacts to water quality and aquatic resources at the dredging and disposal sites. Impacts during dredging and disposal would include a temporary increase in turbidity and minor release of certain contaminants. No significant effect upon the water quality in the vicinity is expected. Bioassay tests indicate disposal would not cause any acute chemical impacts to organisms
W86-03297

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER, RIVER MILE 480 TO 530: REPORT 1, INTRODUCTION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller.
Miscellaneous Paper E-80-1, U.S. Army Environmental and Water Quality Operational Studies, March 1981. 34 p, 2 fig, 2 tab, 57 ref.

Descriptors: *Ecological effects, *Environmental effects, *Dikes, *Channels, *Water quality management, *Navigable rivers, *Channel improvement, *Water resources development, Pilot studies, Surveys, Species, Composition, Species diversity, Environmental impact statement, Mississippi River, Rivers, Aquatic habitats, Benthos, Bank Stabilization, Aquatic populations, Aquatic life, *Mississippi River.

A pilot survey was carried out on river mile 480 to 530 of the Lower Mississippi River from April to October 1978 to collect data on fish, benthos, and water quality as they are effected by the placement and design of navigational structures such as dikes, bank revetments, and bendway cutoffs. Data obtained from these studies was used to design further waterway investigations. Fourteen different habitats were identified in the study area: main channel, permanent secondary channel, temporary secondary channel, natural sandbars, natural banks, revetted banks, dike field sandbars, dike field pool areas, abandoned river channels (not contiguous with main channel), oxbow lake, borrow pit, inundated floodplain, and sandbar slack water pools. The placement of dikes and revetments in rivers may alter the distribution, abundance, species composition and diversity of aquatic organisms. A complete discussion of the fisheries, benthos, and water quality investigations along the Lower Mississippi are found in Reports 2 through 8 of this series.
W86-03302

CONSIDERATIONS IN SELECTING BIOASSAY ORGANISMS FOR DETERMINING THE POTENTIAL ENVIRONMENTAL IMPACT OF DREDGED MATERIAL,
EG and G Bionomics, Pensacola, FL. Marine Research Lab.
For primary bibliographic entry see Field 5C.
W86-03319

EFFECTS OF OPERATING THE MT. ELBERT PUMPED-STORAGE POWERPLANT ON TWIN LAKES, COLORADO: 1981 REPORT OF FINDINGS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. F. LaBounty, and J. J. Sartoris.
Report No REC-ERC-83-2, December 1982. 88 p, 43 fig, 17 tab, 2 app, 44 ref.

Descriptors: *Pumped storage, *Powerplants, *Ecological effects, *Aquatic environment, *Reservoirs, *Limnology, *Environmental effects, Chemical properties, *Lakes, Ecology, Phytoplankton, Fish, Shrimp, Twin Lakes, Colorado, Mt. Elbert Pumped-Storage Powerplant.

A series of studies is being performed to identify and quantify changes that occur in the aquatic ecology of Twin Lakes, Colorado, because of the Mt. Elbert Pumped-Storage Powerplant, which began operation in August 1981. The results presented here are part of the investigations being done by the Bureau of Reclamation on the ecological effects of pumped-storage construction and operation. These studies have been going on since 1971. The Twin Lakes and the powerplant are being used for the primary field investigations. Although it is too early to identify any ecological changes, this report presents results of studies done in 1981. These results, along with those from other studies done since 1971 when the project began, are being used to define the preoperational limnology of Twin Lakes. Twin Lakes are a pair of dimictic, connected, montane, drainage lakes of glacial origin. Based on seven limnological parameters, the lakes are classified as oligotrophic lakes. Maximum water temperature of 18 C were recorded in August 1981 for both lakes. The lowest measure dissolved oxygen concentration during 1981 was 1.7 mg/L at the bottom of the lower lake in October. Total phosphorus concentrations during 1981 ranged from 1 microgram/L, which has been the case most of the time during the past 6 years, to a high of 31 micrograms/L. Nitrate nitrogen concentrations ranged from <10 to 170 micrograms/L. Average daily primary productivity rates during 1981 ranged from a low of 84 mg C/(sq m.d) in the upper lake during March to a high of 126.6 mg C/(sq m.d) in the lower lake during May. Chlorophyll a concentrations during 1981 ranged from a mean concentration of 0.4 mg/cu m in the lower lake during May to a mean of 18.8 mg/cu m in the upper lake during September. Average phytoplankton and zooplankton densities reached maximums of just over 18,000 organisms/L (lower lake - Sept.) and 153 individuals/L (lower lake - June), respectively. Phytoplankton populations were dominated by diatoms and dinoflagellates, while zooplankton populations were dominated by copepods, opossum shrimp, and various species of rotifers. Large pelagic cladocerans are notably absent from Twin Lakes. The benthos includes chironomid larvae, oligochaetes, and fingernail clams.
W86-03336

COMMON PLANKTON OF TWIN LAKES, COLARADO,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
D. V. Lieberman.
Available from Engineering and Research Center, Denver, CO. Report No REC-ERC-82-21, February 1983. 17 p, 15 fig, 3 tab, 1 app, 16 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Taxonomy, *Aquatic Life, Lakes, Powerplants, Pumping plants, Algae, Rotifers, Copepods, Shrimp, Chrysophyta, Chlorophyta, Diatoms, Cyanophyta, Twin Lakes, Colorado.

A series of studies is being performed to evaluate the effects of the Mt. Elbert Pumped-Storage Powerplant on the ecology of Twin Lakes. Twin Lakes are a pair of connected dimictic lakes, formed as the result of glacial action on alluvial deposits. This report presents a taxonomic species study of the common plankton collected since 1974 from Twin Lakes. A total of 11 zooplankters and 14 phytoplankters were identified from the limnetic zone of Twin Lakes and the associated Mt. Elbert Forebay. The four divisions of zooplankton included four species of Rotifer (rotifer), three species of Copepoda (copepod), three species of Cladocera (cladoceran), and one species of Mysidacea (opposum shrimp). The dominant zooplankters were the rotifers and copepods. The nocturnal opossum shrimp, Mysis relicta are abundant in Twin Lakes but were not collected in plankton samples. Cladocerans were rarely collected and made up less than 1% of the zooplankton population. The lower lake has a greater density of zooplankton than the upper lake. For example, in July 1981, average zooplankton densities in the lower lake reached a maximum of 116 individuals/L, as compared to 53 individuals/L in the upper lake. The four divisions of phytoplankton included three species of Chrysophyta (blue-green algae), three species of Chlorophta (green alg), six species of Bacillariophyta (diatom), and two species of Cyanophyta (yellow-brown algae). The phytoplankton was dominated by the yellow-brown algae, Dinobryon, and by the diatoms, asterionella and Synedra. During 1981, average density of phytoplankton reached a maximum of 4870 organisms/L during September in the upper lake; the average density in the lower lake peaked during March at 18,042 organisms/L.
W86-03337

INTERMEDIATE-DISTURBANCE HYPOTHESIS: AN EXPLANATION FOR BIOTIC DIVERSITY PATTERNS IN LOTIC ECOSYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 5C.
W86-03391

INVERTEBRATE DRIFT AND PARTICULATE ORGANIC MATERIAL TRANSPORT IN THE SAVANNAH RIVER BELOW LAKE HARTWELL DURING A PEAK POWER GENERATION CYCLE,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 5B.
W86-03392

7. RESOURCES DATA

7A. Network Design

HYDROLOGIC BENCH-MARK PROGRAM AS A STANDARD TO COMPARE AND EVALUATE TIME-SERIES TRENDS IN SELECTED

Group 7A—Network Design

WATER-QUALITY CONSTITUENTS FOR STREAMS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
G. R. Buell, and S. C. Grams.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4318, 1985. 36 p, 16 fig, 3 tab, 19 ref.

Descriptors: *Water quality, *Seasonal Kendall test, Land cover, Land use, Atmospheric deposition, *Georgia, Hydrologic Bench-Mark, *Temporal trends.

Significant temporal trends in monthly pH, specific conductance, total alkalinity, hardness, total nitrite-plus-nitrite nitrogen, and total phosphorus measurements at five stream sites in Georgia were identified using a rank correlation technique, the seasonal Kendall test and slope estimator. These sites include a U.S. Geological Survey Hydrologic Bench-Mark site, Falling Creek near Juliette, and four periodic water-quality monitoring sites. Comparison of raw data trends with streamflow-residual trends and, where applicable, with chemical-discharge trends (instantaneous fluxes) shws that some of these trends are responses to factors other than changing streamflow. Percentages of forested, agricultural, and urban cover with each basin did not change much during the periods of water-quality record, and therefore these non-flow-related trends are not obviously related to changes in land cover or land use. Flow-residual water-quality trends at the Hydrologic Bench-Mark site and at the Chattooga River site probably indicate basin reponses to changes in the chemical quality of atmospheric deposition. These two basins are predominantly forested and have received little recent human use. Observed trends at the other three sites probably indicate basin responses to various land uses and water uses associated with agricultural and urban land or to changes in specific uses. (USGS)
W86-02940

LONG-RANGE PLANS FOR HYDROLOGIC INVESTIGATIONS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-02945

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
R. R. Mason, and N. M. Jackson.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4036, 1985. 109 p, 12 fig, 14 tab, 18 ref.

Descriptors: *Network design, *Time series analysis, *Research priorities, *Cost analysis, *Gaging stations, *North Carolina, Kalman filtering, *Cost effectiveness.

This report documents the results of a study of the cost-effectiveness of the stream-gaging program in North Carolina. Data uses and funding sources are identified for the 146 gaging stations currently operated in North Carolina with a budget of $777,600 (1984). As a result of the study, eleven stations are nominated for discontinuance and five for conversion from recording to partial-record status. Large parts of North Carolina's Coastal Plain are identified as having sparse streamflow data. This sparsity should be remedied as funds become available. Efforts should also be directed toward defining the efforts of drainage improvements on local hydrology and streamflow characteristics. The average standard error of streamflow records in North Carolina is 18.6 percent. This level of accuracy could be improved without increasing cost by increasing the frequency of field visits and streamflow measurements at stations with high standard errors and reducing the frequency at stations with low standard errors. A minimum budget of $762,000 is required to operate the 146-gage program. A budget less than this does not permit proper service and maintenance of the gages and recorders. At the minimum budget, and with the optimum allocation of field visits, the average standard error is 17.6 percent. (USGS)
W86-02973

GEOCHEMICAL SURVEY TO DETERMINE WATER-QUALITY CHARACTERISTICS OF THE BIG SIOUX AQUIFER IN EASTERN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03019

DATA USES AND FUNDING OF THE STREAM-GAGING PROGRAM IN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
L. A. Waite.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-868, 1984. 32 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Cost analysis, *Hydrologic-data collection, Gaging stations, Surface water, Water quality, *Missouri.

This report documents the results of a study of the data uses and funding of the stream-gaging program in Missouri. Presently (1984), 100 continuous-record streamflow-gaging stations are operated in Missouri on a budget of $633,345. Data uses and funding sources are identified for each of the stations. Data from most stations have multiple uses. All stations presently have sufficient justification for continuation. (USGS)
W86-03070

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
R. D. Schopp, and R. L. Ulery.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4108, 1984. 97 p, 15 fig, 18 tab, 23 ref.

Descriptors: *Cost analysis, Stream gages, *Optimization, *Streamflow, Synthetic hydrology, Multiple regression analysis, Data acquistion, Model studies, Network design, *New Jersey, *Stream-gaging program, Flow routing.

The results of a study of the cost-effectiveness of the stream-gaging program in New Jersey are documented. This study is part of a 5-year nationwide analysis undertaken by the U.S. Geological Survey to define and document the most cost-effective means of furnishing streamflow information. This report identifies the principal uses of the data and relates those uses to funding sources, applies, at selected stations, alternative less costly methods (that is flow routing, regression analysis) for furnishing the data, and defines a strategy for operating the program which minimizes uncertainty in the streamflow data for specific operating budgets. Uncertainty in streamflow data is primarily a function of the percentage of missing record and the frequency of discharge measurements. In this report, 101 continuous stream gages and 73 crest-stage or stage-only gages are analyzed. A minimum budget of $548,000 is required to operate the present stream-gaging program in New Jersey with an average standard error of 27.6 percent. The maximum budget analyzed was $650,000, which resulted in an average standard error of 17.8 percent. The 1983 budget of $569,000 resulted in a standard error of 24.9 percent under present operating policy. (USGS)
W86-03073

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN ORLANDO SUBDISTRICT, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03086

STREAM-GAGING PROGRAM IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
J. R. Little, and D. K. Matthews.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-564, 1985. 29 p, 2 fig, 2 tab, 4 ref.

Descriptors: *Surface water, *Streamflow, *Gaging stations, Basic data collections, *South Dakota.

This report documents the results of a study of the uses, funding, and availability of the streamflow information program in South Dakota. In 1983, 107 continuous-record surface-water gaging stations were being operated in South Dakota on a budget of $607,050. Data from most stations have multiple uses. Data uses and funding sources are identified for each station. All stations have sufficient justification for continuation although 10 are primarily used to provide data for short-term research studies. The continued operation of these 10 stations should be evaluated when the studies have been completed. (USGS)
W86-03105

MANAGEMENT OF WATER QUALITY DATA WITHIN THE CORPS OF ENGINEERS, 1979,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
M. H. Smith, and P. L. Doiron.
Miscellaneous Paper E-80-2, U.S. Army Environmental and Water Quality Operational Studies, December 1980. Final Report. 70 p, 7 tab, 7 app.

Descriptors: *Surveys, *Water quality, *Data processing, *Data storage and retrieval, *Data transmission, *Data acquisition, *Computer programs, Water quality management, Automation, Data collections, Computers.

A survey of current practices, needs, and recommendations in water quality data management by the U.S. Army Corp of Engineers (CE) Districts and Divisions showed an awareness of the responsibility of the CE for the quality of water in all its Civil Works projects and for reporting the findings. Of the 37 Districts, 33 are already participating in the annual reporting system with 23 Districts using some kind of automated data analysis and/or data storage and retrieval. STORET is the most preferred system with the 13 Districts and 3 Divisions that use it. Modification of STORET for the CE, with its own data base maintained by the CE was recommended by several Districts. The increase in water management activities on over 500 CE Civil Works reservoirs will be accompanied by a demand for an efficient data management system to allow compliance with CE regulations. Other automated systems in use (AURAS, SIR, SAS and UPGRADE, WATSTORE and NAWDEX) are compared. Before the CE adopts a unified data management system it is recommended that candidate systems be evaluated in detail by experienced users and a CE panel of experts, and that the future data management needs and personnel capabilities within all Districts over the next 10 years be assessed.
W86-03313

7B. Data Acquisition

LONG-RANGE PLANS FOR HYDROLOGIC INVESTIGATIONS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
H. L. Case, and G. E. Welder.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-696, 1983. 25 p, 9 fig, 1 tab.

Descriptors: *Water resources planning, Water supply, Groundwater, Surface water, Water quality, *Water requirements, *Data collections,

Aquifers, Water pollution, *New Mexico, Mineral extraction, Basin assessment.

Objectives of the hydrologic-data-collection projects presented in this report include continuing to identify future data needs; conducting an analysis of the water-quality, ground-water, and surface-water observation networks; and entering all available current and historical hydrologic data into the U.S. Geological Survey Water Data Storage and Retrieval System (WATSTORE). Objectives of areal-appraisal studies include evaluating the water resources in the Gallup-Grants-Zuni-Acoma Sag area and on the eastern flank of the Sandi and Manzano Mountains in Bernalillo County. Potential projects for basin assessments include quantifying the ground-water/surface-water relationships on rivers with flows governed by compacts and an investigation of the water resources of the Estancia Basin. Projects that will assist in the evaluation of energy-related activities include describing the effects of resaturation of coal mines and of milling operations on the quality and quantity of ground and surface water. Activities that need to be undertaken to assist in addressing waste-disposal problems include the evaluation of the hydrologic factors influencing the feasibility of cleanup at the Albuquerque South Valley 'superfund' site and the establishment of a monitoring network at the Waste Isolation Pilot Plant project near Carlsbad. Scientific methods that need to be developed include (1) the testing of analytical techniques for estimating site-specific conditions with the results of digital hydrologic models, and (2) the determination of the influence of recharge from ephemeral streams on alluvial aquifers. (USGS)
W86-02945

LOW-FLOW DATA FOR SELECTED PARTIAL-RECORD STATIONS IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
R. R. Schwarts.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-824, 1985. 13 p, 2 fig, 1 tab, 9 ref.

Descriptors: *Low flow, *Streamflow, Data collections, *Ohio, Partial-record stations, Stream gaging.

Low-flow characteristics for 67 low-flow partial-record stations defined in Ohio since the 1978 water year are presented. Low-flow characteristics presented ar the 7-day 10-year low flow, the 7-day 2-year low flow, and the flow equalled or exceeded 90 percent of the time. The 7-day 10-year low-flow ranged from 0 ft3 to 239(3)/s. The methods used for estimating these characteristics also are discussed. (USGS)
W86-03003

PERFORMANCE OF ICE METER AND WEIGHT ASSEMBLIES,
Geological Survey, NSTL Station, MS. Water Resources Div.
V. R. Schneider, and J. C. Futrell.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4035, 1984. 26 p, 10 fig, 8 tab, 1 ref.

Descriptors: Discharge, Errors, *Flow measurement, Ice, Velocity, *Flow meters, *Flow under ice measurement, Van ice meter, Velocity measurement, WSC winter meter.

The performance of three ice meters and weight assemblies used by the U.S. Geological Survey and Environment Canada were compared in a towing tank. Each meter was rated individually on a rod suspension and then rerated on a cable suspension, with the appropriate weight assembly. Vertical and veer cable angles were measured along with meter yaw angle. The effect of the weight assembly on the rod-suspension rating for each meter was illustrated by computing a correction coefficient which ranged between 0.88 and 1.10 depending on the weight system used and the fluid velocity. A sluch-n-all type weight assembly least affected the meter rating and was the most stable in all flow conditions. (USGS)
W86-03004

BOUGUER GRAVITY ANOMALY MAP OF THE TWENTYNINE PALMS MARINE CORPS BASE AND VICINITY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
W. R. Moyle.
Available from OFSS, USGS, Box 25425, Lakewood. CO 80225. USGS Water-Resources Investigations Report 84-4005, 1984. 24 p, 2 fig, 1 tab, 43 ref.

Descriptors: *Groundwater barriers, *Gravity studies, Wells, Density, Water-level fluctuations, *California, Twentynine Palms, Landers, Joshua Tree, Sunfair.

A gravity study of the Twentynine Palms Marine Corps Base and vicinity, California, based on 495 gravity measurements, has been completed. The resulting contour map of the area shows that the ground-water basin ranges in depth from less than a foot at the edges of the basin to about 10,500 feet at the center of a gravity low near Deadman Lake. This study will aid in later studies to determine quantities of water in storage beneath the Marine Corps Base. (USGS)
W86-03006

MEASURING THE SURFACE AREA OF SEDIMENT-PARTICLES,
Geological Survey, Minneapolis, MN. Water Resources Div.
J. V. Skinner.
Available from Fed Inter-Agency Sed Proj, St. Anthony Falls Hyd Lab, Hennepin Is., 3rd Ave, SE Minneapolis, MN 55414. Report FF of A Study of Methods Used in Measurement and Analysis of Sediment Loads in Streams, U.S. Corps of Engineers, 1984. 28 p, 6 fig, 4 tab, 4 ref.

Descriptors: *Suspended sediments, *Measuring instruments, Physical properties, Turbidity, Light penetration, Radiation.

Light traveling through a suspension of water and fluvial sediment is scattered and absorbed by the particles. Several investigators have studied this attenuation process in an effort to devise optical techniques for measuring sediment concentration. Unfortunately, most of these efforts have not been successful because the relationship between attenuation and concentration is strongly influenced by the size distribution of the sediment particles. In this report, an analysis of experimental data shows that the attenuation of infrared light is closely correlated with the total 'geometric surface area' (GSA) of the particles suspended in a unit volume of the water. The GSA of an individual particle is defined as the area of a sphere having a diameter equal to the particles's diameter. The correlation between attenuation and total GSA holds for a broad range of particle diameters. The lower limit is about 2 micrometers; the upper limit is greater than 115 micrometers, the diameter of the largest particles tested. The range in GSA per unit volume extends from zero to more than 0.055 square meters per liter. The latter value is equivalent to full-scale deflection on the infrared light meter. (USGS)
W86-03007

WATER RESOURCES DIVISION WATER LEVEL RECORDER RENTAL PROGRAM - HISTORY AND OPERATION,
Geological Survey, NSTL Station, MS. Water Resources Div.
S. R. Jeffers, and C. R. Wagner.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-735, 1984. 16 p, 4 fig, 3 tab.

Descriptors: *Instruments, Equipment, *Water level recorder, Cost analysis, Optimization, Rent, Management planning.

The U.S. Geological Survey introduced a new water level recorder in the early 1960's to automate computation of streamflow records. At the same time it developed a rental program as a means of providing the recorders to field offices. This report documents the experience gained over the past 20 years and offers suggestions for operation of a rental program in the future, as preparation is made to introduce a third generation of water level recorders. (USGS)
W86-03009

RESULTS OF THE U.S. GEOLOGICAL SURVEY'S SECOND INTERNATIONAL INTERLABORATORY ANALYTICAL COMPARISON STUDY--STANDARD-REFERENCE WATER SAMPLES M-86 (MAJOR CONSTITUENTS), T-87 (TRACE CONSTITUENTS), AND P-5 (PRECIPITATION SNOWMELT),
Geological Survey, Denver, CO. Water Resources Div.
V. J. Janzer.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4049, 1985. 85 p, 13 tab, 2 ref.

Descriptors: *Reference samples, *Reference materials, *Standards, *Quality assurance, *Water analysis, Quality control, Statistical analysis, Water quality, Standard reference water samples.

The U.S. Geological Survey began an interlaboratory testing program of standard-reference water samples in 1962. Program objectives have been to provide a means for participating anaytical laboratories to: (1) Identify analytical problems, (2) ascertain the accuracy and precision of common water analyses and analytical methods, and (3) obtain reference samples for continuing quality-assurance testing. Participation in this continuing quality-assurance program is mandatory for all domestic laboratories providing water-analysis data for Survey use and storage in the WATSTORE data-storage system, if appropriate standard-reference water samples are available. The program was expanded in October 1982 to include laboratories in other countries. This report presents analytical data submitted by the 53 laboratories in other countries that analyzed the standard-reference water samples distributed in October 1983. Statistical evaluation of the data and performance ratings achieved by the laboratories for each determination are given in nine tables. Comparisons of the most probable values for the constituents determined by both other countries and domestic laboratories also are presented. (USGS)
W86-03013

DISCHARGE RATINGS AT GAGING STATIONS,
Geological Survey, Reston, VA. Water Resources Div.
E. J. Kennedy.
Available from Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304. USGS Techniques of Water Resources Investigations, Book 3, Chapter 10, 1984. 59 p, 26 fig, 3 tab, 10 ref.

Descriptors: *Stage-discharge relations, *Stream gages, *Hydrometry, Channel flow, Water measurement, Discharge ratings, Streamflow measurement.

A discharge rating is the relation of discharge at a gaging station to stage and sometimes also to other variables. This chapter of 'Techniques of Water Resources Investigations' describes the common procedures used to develop simple ratings (stage-discharge) and the most frequently encountered types of complex ratings (stage-rate of change in stage-discharge, stage-fall-discharge, and stage-index velocity-discharge). Fundamental techniques of logarithmic plotting and simple storage routing applications to rating development are demonstrated. Computer applications, especially for handheld programmable calculators, and data handling are stressed. (USGS)
W86-03029

USES, FUNDING, AND AVAILABILITY OF CONTINUOUS STREAMFLOW DATA IN MONTANA,

Geological Survey, Helena, MT. Water Resources Div.
R. R. Shields, and M. K. White.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-862, 1985. 61 p, 3 fig, 2 tab, 6 ref.

Descriptors: Stream gages, *Streamflow data, *Hydrologic data, Data collections, *Streamflow-gaging program, *Montana.

This report documents the results of a study of the uses, funding, and availability of continuous streamflow data collected and published by the U.S. Geological Survey in Montana. Data uses and funding sources are identified for the 218 continuous streamflow gages currently (1984) being operated. These stations are supported by 18 different funding sources at a budget for the 1984 water year of $1,065,000. The streamflow-gaging program in Montana has evolved through the years as Federal, State, and local needs for surface-water data have increased. Continuous streamflow records for periods ranging from less than 1 year to more than 90 years have been collected. This report describes phase 1 of a cost-effectiveness study of the streamflow-gaging program in Montana. Evaluation of the program indicates that numerous agencies use the data for studies involving regional hydrology, hydrologic systems, and planning and design. They also use the data for operations of existing hydroelectric and irrigation dams, forecasting flood and seasonal flows, water-quality monitoring, research studies for fish habitat, and other uses such as recreational management. (USGS)
W86-03036

MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH SEPTEMBER 1981,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03038

SURFACE TOPOGRAPHY OF THE LOWER PART OF COLUMBIA GLACIER, ALASKA, 1974-1981,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W86-03039

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Reston, VA. Water Resources Div.
J. F. Wilson, E. D. Cobb, and F. A. Kilpatrick.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-234, 1984. 53 p, 13 fig, 3 tab, 32 ref.

Descriptors: *Dyes, Dye concentrations, *Fluorometry, *Fluorescence, *Tracers, Streamflow, Groundwater movement, *Fluorometers, Rhodamine WT, Pontacyl pink, Acid yellow 7.

This manual describes the current fluorometric procedures used by the U.S. Geological Survey in dye tracer studies such as time of travel, dispersion, reaeration, and dilution-type discharge measurements. The outstanding characteristics of dye tracing are: (1) the low detection and measurement limits, and (2) the simplicity and accuracy of measuring dye tracer concentrations using fluorometric techniques. The manual contains necessary background information about fluorescence, dyes, and fluorometers and a description of fluorometric operation and calibration procedures as a general guide for laboratory and field use. The background information should be useful to anyone wishing to experiment with dyes, fluorometer components, or procedures different from those described. In addition, a brief section is included on aerial photography because of its possible use to supplement ground-level fluorometry. (USGS)
W86-03043

STREAM-GAGING PROGRAM IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Kircher, and H. E. Petsch.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-451, 1984. 48 p, 2 fig, 8 ref.

Descriptors: Stream discharge, *Gaging stations, Hydrologic data collection, *Colorado, *Streamgaging program, Cooperators, Funding.

This report documents the results of a study of the streamflow information program in Colorado. Presently (1983), 353 continuous surface-water stations are operated in Colorado on a budget of $2,005,786. Data uses and funding sources are identified for each of the 353 stations. Data from most stations have multiple uses. (USGS)
W86-03057

FIELD GUIDELINES FOR COLLECTION, TREATMENT, AND ANALYSIS OF WATER SAMPLES, MONTANA DISTRICT,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-409, 1985. 86 p, 7 fig, 8 tab, 12 ref.

Descriptors: Bacteria, Dissolved oxygen, Field tests, Sample preparation, Sample preservation, Samplers, Specific conductance, Water analyses, *Data collections, *Sampling, *Water quality, *Montana, Hydrogen ion concentration.

This manual provides a set of standardized guidelines and quality-control procedures for the collection and preservation of water samples and defines procedures for field analyses of unstable constituents or properties. Seldom is the water being samples of such uniformity that a single grab sample is representative of the whole. For this reason a variety of sampler types and sampling methods have been devised. Descriptions and procedures for field use are given for a number of sampler types. Several methods of sampling are described for which these samplers can be used. Sample-processing devices such as sample splitters and filtration apparatus are discussed along with methods of cleaning. Depending on the type of analysis to be performed in the laboratory, samples may need to be preserved shortly after collection. Various types of preservation are described in detail. Analyses for unstable constituents or properties are of necessity accomplished in the field. This manual addresses analytical techniques and quality assurance for: (1) Water temperature, (2) specific conductance, (3) pH, (4) alkalinity, (5) dissolved oxygen, and (6) bacteria. Examples of field report forms are given as attachments. Information pertinent to certain field calculations is also presented. (USGS)
W86-03060

TEST WELLS IN CENTRAL WASHINGTON, 1977-79: DESCRIPTION AND RESULTS,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03062

ANNUAL YIELD AND SELECTED HYDROLOGIC DATA FOR THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS OKLAHOMA, 1984 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03074

GROUND-WATER RESOURCES OF BOTTINEAU AND ROLETTE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03075

GROUND-WATER QUALITY APPRAISAL OF SURFICIAL SAND-PLAIN AQUIFERS IN HUBBARD, MORRISON, OTTER TAIL, AND WADENA COUNTIES, MINNESOTA,
Geological Survey, Grand Rapids, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03080

HYDROLOGIC INSTRUMENTATION FACILITY OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, NSTL Station, MS. Water Resources Div.
C. R. Wagner, and S. Jeffers.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-227, 1984. 18p, 9 fig.

Descriptors: *Instruments, Equipment, Facilities, *Instrumentation support, Centralized facility.

The U.S. Geological Survey Water Resources Division has improved support to the agencies field offices by the consolidation of all instrumentation support services in a single facility. This facility known as the Hydrologic Instrumentation Facility (HIF) is located at the National Space Technology Laboratory, Mississippi, about 50 miles east of New Orleans, Louisiana. The HIF is responsible for design and development, testing, evaluation, procurement, warehousing, distribution and repair of a variety of specialized hydrologic instrumentation. The centralization has resulted in more efficient and effective support of the Survey's hydrologic programs. (USGS)
W86-03164

TOTAL PRECIPITABLE WATER AND RAINFALL DETERMINATIONS FROM THE SEASAT SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR),
National Environmental Satellite, Data, and Information Service, Washington, DC.
For primary bibliographic entry see Field 2B.
W86-03238

HCMM HYDROLOGICAL ANALYSIS IN UTAH,
Brigham Young Univ., Provo, UT. Dept. of Civil Engineering.
A. W. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as N83-13520, Price codes: A08 in paper copy, A01 in microfiche. E83-10026, May 1982. Final Report. 166 p, 72 fig, 26 tab, 62 ref. NAS5--26473.

Descriptors: *Satellite technology, *Mapping, *Water quality, *Lakes, *Model studies, Hydrologic models, Infrared imagery, Remote sensing, Models, Nutrients, Eutrophication, Water temperature, Reflectance, Algae, Plankton, Evaporation, Wind velocity, Groundwater.

The NASA Heat Capacity Mapping Mission (HCMM) Satellite was applied to a study of Utah Lake to develop an accurate model for predicting land and water surface temperatures and to examine the relationship among HCMM sensed surface temperature, reflectivity and water quality factors. The study results indicate that the appropriate offset to be applied to calibrate the HCMM model to the Utah Valley area is +5 degrees Celsius. The statistical analyses performed on the data obtained from the HCMM and the water quality measurements made in Utah Lake in 1978 and 1979 yielded several significant relationships. The strong correlations identified between the day infrared, visual reflectivity measurements, and plankton concentration measurements provided the foundation for the use of the color prints to locate areas of algae growth in Utah Lake. Relationships developed between algae concentrations in the lake and nutrient levels were inconclusive. Comparisons of wind and wind speed functions derived from HCMM data

failed to yield a significant correlations. Utah Lake monthly modeled evaporation and pan evaporation correlated well with HCMM day and night temperatures. For short time intervals (days), the night data might be useful in estimating evaporation while for monthly evaporation either night or day data appears useful. The study relating off-season groundwater depth to HCMM sensed thermal IR intensity yielded a mode with a very good correlation to ground truth. (Geiger-PTT)
W86-03241

NEW INSTRUMENTATION FOR AIRBORNE ACID-RAIN RESEARCH,
Brookhaven National Lab., Upton, NY. Environmental Chemistry Div.
R. L. Tanner, P. H. Daum, and T. J. Kelly.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-019543, Price codes: A02 in paper copy, A01 in microfiche. BNL--31596, April 1982. 20 p, 4 fig, 3 tab, 13 ref. DE-AC02-76CH00016.

Descriptors: *Chemical analysis, *Acid rain, Air pollution, Chemical properties, Acidity, Acids, Sulfuric acid, Sulfides, Sulfur, Nitrogen.

Instrumental methods developed for continuously measuring sulfur dioxide, aerosol sulfur, nitrogen oxides, nitric acid, and ammonia from an aircraft sampling platform are described. Emphasis is on modifications to reduce limits of detection to allow sampling at ambient concentrations in the vicinity of clouds. The use of these data in conjunction with data on cloud water composition and knowledge of the interphase behavior of nitrogen and sulfur oxides and oxyacides, for quantitative evaluation of species contributions to the ionic content of precipitation, is described. Specific instrumentation that is discussed includes a flame photometer with enhanced sensitivity for sulfur compounds; modified ozone-chemiluminescence detectors for nitric acid and nitrous oxides; and a fluoresence derivatization technique for ammonia analysis. (Halterman-PTT)
W86-03242

SATELLITE OBSERVATION OF GREAT LAKES ICE: 1980-81,
National Environmental Satellite, Data, and Information Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W86-03258

UPDATE OF TEXAS LAND COVER MAPS BY COMPUTER-ASSISTED ANALYSIS OF LANDSAT DIGITAL DATA: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
TNRIS-025, April 1981. 23 p, 3 fig, 1 append.

Descriptors: *Natural resources, *Texas, *Information systems, Information exchange, Information retrieved, Geography, Computers, Automation, Computer programs, Mapping, Geologic mapping, Hydrologic maps.

In response to a request by the Texas Department of Water Resources (TDWR), the Texas Natural Resources Information System has utilized computer-assisted digital image processing techniques to map Land Cover/Land Use of the Austin Quadrangle Area from Landsat digital data. The objective of the project was to determine the feasibility of using a computer-assisted approach for updating the land use/land cover maps of the state previously compiled by the TDWR from Landsat paper enlargements to satisfy requirements of the Federal Water Pollution Control Act of 1972. Results of the computer-assisted analysis consisted of a 1:250,000 scale land cover map with categories based on the U.S. Geological Survey's recommendations as outlined in Professional Paper 964. Accuracy of the computer-generated product was determined to be 93% compared to 84% for the visually-interpreted map. Despite encouraging results, however, further studies in other physiographic regions of the State will be necessary to determine if the computer-assisted techniques can be successfully applied on a statewide basis for this particular application. (Author)
W86-03272

LIMNOLOGICAL APPLICATIONS OF MULTISPECTRAL REMOTE SENSING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. P. Verdin.
REC-ERC-84-2, June 1984. 51 p, 58 fig, 18 tab, 38 ref, 1 append.

Descriptors: *Remote sensing, *Limnologic data collection, Satellite technology, Sensors, Reservoirs, Resource management, Eutrophication, Water quality, Water sampling, Regression analyses, Chlorophyll a.

Results are reported for a 3-year study to assess the utility of multispectral remote sensing for characterizing reservoir water quality conditions. The essence of the approach employed was the relation by regression methods of simultaneously acquired water quality measurements and digital imagery values. Application of the regression equations to entire scenes achieved a spatial extrapolation of the point measurements of water quality. Secchi transparency and chlorophyll a concentration were the water quality variables modeled with greatest success. Both Landsat and airborne multispectral scanner data were employed. In addition, an atmospheric correction was made to account for date-to-date variations in Landsat imagery. This made possible the development of water quality predictive regression equations using data from several dates at once. It also permitted the estimation of reservoir conditions for scenes without concurrent surface sampling data available. A comparison of corrected and uncorrected Landsat image formats is provided, and data processing problems discussed. (Author)
W86-03277

WORKSHOP ON RIVERINE WATER QUALITY MODELING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
L. S. Johnson, D. E. Ford, and D. L. Robey.
Miscellaneous Paper E-81-1, U.S. Army Environmental and Water Quality Operational Studies, February 1981. Final Report. 29 p, 2 tab, 2 app, 10 ref.

Descriptors: *Model studies, *Models, *Rivers, *Water quality, *Hydrologic models, *Symposiums, *Technology transfer, *Mathematical models, Reservoir releases, Dredging, Water quality management, Sediment transport, Data collections, Suspended solid.

A Riverine Water Quality Modeling Workshop held at the U. S. Army Engineer Waterways Experiment Station in April of 1980 defined environmental/water quality problems in large rivers encountered by Corp of Engineer Offices, discussed the adequacy of state-of-the art river models for addressing these problems, and identified possible areas for further improvement of the models under the Environmental and Water Quality Operational Studies Program. Problems associated with water quality were subdivided into three groups: reservoir release, dredging related problems, and several general problems. Modeling problems encompassed such factors as the limitations of one-dimensional steady-state models and problems of model application and costs. Workshop participants recommended collecting data sets for a one-dimensional unsteady flow water quality model and for a two-dimensional vertically averaged model. Other recommendations included improvements for technology transfer and the development and verification of a mathematical algorithm for the transport of fine suspended sediments.
W86-03293

INTERNATIONAL COMPARISON OF NATIONAL PRECIPITATION GAUGES WITH A REFERENCE PIT GAUGE,
World Meteorological Organization, Geneva (Switzerland).
B. Sevruk, and W. R. Hamon.
Instruments and Observing Methods, Report No 17, WMO/TD-No 38, October 1984. 155 p, 9 fig, 14 tab, 55 ref, 6 append.

Descriptors: *Data acquisition, *Measuring instruments, *Rain gages, *Precipitation, Gages.

The average differences between the semidaily amounts of rain as measured by national gages elevated above the ground, and the ground level pit gage were studied at 60 locations throughout the world. Differences ranged from zero to 20%, with an average of 3%. The plots of percentage differences against wind speed at the level of the gage orifice for six evaluation stations showed a considerable scatter. The effect of wind speed was more evident at stations with small rainfall intensities or large values of the percentage proportion (N) of rain falling at intensity equal or smaller than 0.03 mm/min. The evaporation loss estimated at four stations was negligible, 0.2 to 0.9% for the national gages and 0 to 1.3% for the pit gage. The wetting loss was 1 to 9%. The systematic error of point precipitation measurement was 3.5% for the Australian gage, up to 22.3% for the Hellmann gage in Denmark, and 11.7% for the Finnish gage. This report confirms the fact that rainfall as measured by the standard gages elevated above ground is subject to a systematic error which can be corrected. The countries or regions where these corrections are most important are identified. Procedures for introducing corrections into standard practice are described. (Cassar-PTT)
W86-03414

7C. Evaluation, Processing and Publication

RAINFALL-RUNOFF DATA IN THE ALBUQUERQUE, NEW MEXICO, METROPOLITAN AREA, 1976-83,
Geological Survey, Albuquerque, NM. Water Resources Div.
E. E. Fischer, J. J. Rote, and J. P. Borland.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-448, 1984. 306 p, 10 fig, 15 tab, 3 ref.

Descriptors: *Urban hydrology, *Rainfall-runoff relationships, Unit-value data, Daily-value data, Gaging stations, Data collections, *Hydrologic data, Albuquerque, *New Mexico.

Rainfall and discharge data from 13 flood-hydrograph stations in the Albuquerque, New Mexico, metropolitan area are presented. The period of record is from 1976, when the first three stations were installed, through 1983. The data include daily mean values for discharge for the period of record at each station, monthly rainfall totals, and selected rainfall-discharge unit values. Unit-value data are presented at 5-minute intervals; where there is more than one raingage in a drainage basin, the data from all the gages are presented together. Maps of the respective drainage basins are furnished. (USGS)
W86-02933

HISTORICAL WATER-QUALITY DATA FOR THE CLARK FORK (RIVER) AND THE MOUTHS OF SELECTED TRIBUTARIES, WESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-02937

COMPUTER PROGRAM FOR THE COMPUTATION OF TOTAL SEDIMENT DISCHARGE BY THE MODIFIED EINSTEIN PROCEDURE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02964

CHANGES IN CHANNEL GEOMORPHOLOGY OF SIX ERUPTION-AFFECTED TRIBUTARIES OF THE LEWIS RIVER, 1980-82, MOUNT ST. HELENS, WASHINGTON,
Geological Survey, Vancouver, WA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W86-02979

SELECTED TEST-WELL DATA FROM THE MX-MISSILE SITING STUDY, TOOELE, JUAB, MILLARD, BEAVER, AND IRON COUNTIES, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. L. Mason, J. W. Atwood, and P. S. Buettner.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-347, 1985. 13 p, 2 fig, 2 tab, 1 ref.

Descriptors: *Observation wells, *Utah, Great Basin, *Water-level measurements, Lithologic logs, MX-missile drilling program, Well data, Western Utah desert basins.

Ground-water data obtained from the MX-missile siting study in western Utah are presented in this report. The test drilling was divided into two phases, verification and water resources. In the verification phase, numerous borings ranging in depth from 92 to 205 feet were made to obtain data necessary for the design of the MX-basing system. Test wells drilled for the water resources phase ranged in depth from 310 to 1,399 feet; they were designed to determine ground-water availability and to estimate the effects of ground-water withdrawals planned for construction of the MX-basing system. This report includes: well-completion data, water-level measurements, and lithologic logs of selected wells. (USGS)
W86-02980

MAPS TO ESTIMATE AVERAGE STREAMFLOW AND HEADWATER LIMITS FOR STREAMS IN U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT, ALABAMA AND ADJACENT STATES,
Geological Survey, Montgomery, AL. Water Resources Div.
G. H. Nelson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4274. 2 sheets (map), 2 fig, 3 ref.

Descriptors: *Average streamflow, Runoff, Headwaters, Stream gaging stations, *Maps, Army Corps of Engineers, Alabama, Mississippi, Tennessee, Georgia, Florida, *Southeastern U.S.

U.S. Army Corps of Engineers permits are required for discharges of dredged or fill-material downstream from the 'headwaters' of specified streams. The term 'headwaters' is defined as the point of a freshwater (non-tidal) stream above which the average flow is less than 5 cu ft/s. Maps of the Mobile District area showing (1) lines of equal average streamflow, and (2) lines of equal drainage areas required to produce an average flow of 5 cu ft/s are contained in this report. These maps are for use by the Corps of Engineers in their permitting program. (USGS)
W86-02981

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, SEPTEMBER 1984,
Geological Survey, Orlando, FL. Water Resources Div.
L. A. Bradner.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-813, 1984. 1 sheet (map), 1 fig.

Descriptors: *Potentiometric level, *Groundwater, Hydrologic aspects, Aquifer, *Hydrogeology, Sumter County, *Florida, *Maps.

This map presents the potentiometric surface of the Upper Floridan aquifer in central Sumter County, Florida, for September 1984. The Floridan aquifer system is the principal source of potable water in the area. The focus of the map is the potentiometric surface in the Jumper Creek Canal area. Water-level measurements were made on approximately 60 wells. The potentiometric surface ranged in altitude from more than 90 feet in the southeastern part of the county to less than 40 feet northwest of Lake Panasoffkee in the west-central area. (USGS)
W86-02985

QUALITY OF GROUND WATER USED FOR PUBLIC SUPPLY IN FLORIDA, 1983-84,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, R. T. Kirkland, and J. B. Pruitt.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-804, 1985. 1 sheet (map), 1 fig, 5 ref.

Descriptors: *Public water supply, *Groundwater, Priority pollutants, Safe drinking water, Water quality regulations, Trace elements, Organic compounds, *Water quality, Municipal water, *Florida, *Potable water.

From October 1983 through March 1984, a chemical sampling reconnaissance was made of ground water used for public supply for 91 communities throughout Florida. Public supply wells present an excellent network for collecting baseline water-quality information on the quality of ground water prior to any treatment because they are located throughout the State, are in the most populated areas, usually have continuous and often high pumpage, and have great health and economic significance. The reconnaissance was part of several project tasks sponsored by the Florida Department of Environmental Regulation to develop guidelines and data bases for use in the design and implementation of a statewide ground-water monitoring network as mandated by the recent enactment of Florida's Water Quality Assurance Act of 1983. (USGS)
W86-02986

GEOHYDROLOGY OF THE VALLEY AQUIFER IN THE COHOCTON AREA, UPPER COHOCTON RIVER, STEUBEN COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
D. B. Terry, T. S. Pagano, M. L. Shaw, and A. W. Ingram.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4040, 1985. 7 sheets (map), 7 fig, 5 ref.

Descriptors: *Groundwater, *Aquifers, *Groundwater movement, Geologic mapping, Infiltration capacity, Land use, Well yield, Groundwater levels, Steuben County, *New York, Soil permeability, *Geohydrology.

The Cohocton valley-fill aquifer, composed of outwash, kame, and alluvial sand and gravel, is highly productive and is in hydraulic contact with the Cohocton River. Potential well yields range from 50 to more than 1,000 gallons per minute. Most of the aquifer is under shallow water-table conditions and vulnerable to surface contamination. Thickness ranges from 20 to 100 feet. The aquifer lies in an area containing only small communities and therefore is not heavily pumped. Geohydrologic data are compiled on six maps at 1:24,000 scale and in geologic sections. The maps depict surficial geology, soil-infiltration capacity, potentiometric surface, aquifer thickness, well yields, and land use. The maps are designed to help planners evaluate developments that may affect the aquifer, particularly potential contamination sources. This set is one in a series of four that depict selected aquifers in western New York. It supplements a series that is being done by the U.S. Geological Survey in cooperation with State agencies. The maps are based largely on published reports, file data in several State agencies, and field notes. (USGS)
W86-02987

SYNOPSIS OF SALTWATER INTRUSION IN DADE COUNTY, FLORIDA, THROUGH 1984,
Geological Survey, Miami, FL. Water Resources Div.
H. Klein, and B. G. Watter.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4101, 1985. 1 sheet (map), 8 fig, 12 ref.

Descriptors: *Saline-water intrusion, Permeability, *Water management, Drainage, Withdrawals, *Dade County, *Biscayne aquifer, *Florida, South Florida Water Management District.

The inland position of saltwater at the base of the highly permeable limestone of the Biscayne aquifer in Dade County in 1984 is a consequence of: (1) years of adjustment to lowered water levels resulting from regional drainage for flood control and land reclamation; (2) increased freshwater withdrawals; and (3) water-control and water-management practices implemented at the south part of the hydrologic system as well as in upgradient areas. As water demands in southeast Florida continue to increase, further intrusion could be related to increased pumping from well fields. Implementation of additional management practices to further reduce canal discharge to the ocean would tend to sustain water levels high enough to retard intrusion during dry seasons. (USGS)
W86-02988

ESTIMATION OF INCOMPLETE STREAMFLOW FOR SELECTED SITES ON THE CARSON AND TRUCKEE RIVERS IN CALIFORNIA AND NEVADA, 1944-80,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02990

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, BASIN AND RANGE PROVINCE, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
K. A. Sargent, and K. Roggensack.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4119-D, 1983. 81 p, 3 fig, 1 map, 167 ref.

Descriptors: *Granitic rocks, Geology, Hydrogeology, *Maps, Basin and Range province, *Nevada.

Outcrops of granitic rocks have been delineated in Nevada as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The litholigic character, thickness, geologic age, distribution, and sources of data of the granitic rocks, are described. (USGS)
W86-02991

EVALUATION OF THE COST EFFECTIVENESS OF THE 1983 STREAM-GAGING PROGRAM IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-02992

STREAMFLOW AND BASIN CHARACTERISTICS AT SELECTED SITES IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
N. B. Melcher, and K. J. Ruhl.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-704, 1984. 77 p, 2 fig, 14 tab, 12 ref.

Descriptors: *Basin characteristics, *Streamflow characteristics, Hydrologic data, *Kentucky, *Data collections.

Common basin and streamflow characteristics for sites in Kentucky are presented. Basin characteristics include quantified drainage basin parameters

and statistics on areal rainfall. Streamflow characteristics include tables for mean, high and low flow frequencies and partial duration discharge. The data listed in this report are for continuous and low-flow partial-record sites. (USGS)
W86-02993

WATER-LEVEL HYDROGRAPHS FOR OBSERVATION WELLS IN VIRGINIA, 1982,
Geological Survey, Richmond, VA. Water Resources Div.
S. Farrington, N. Carrington, and W. V. Daniels.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-134, 1984. 175 p, 2 fig, 1 tab.

Descriptors: *Observation wells, *Hydrographs, *Hydrologic data, Water wells, Groundwater, *Virginia, Monitoring.

Water-well data for 1982 are presented from 147 observation wells in Virginia. Historical data from two wells are also included. A description of each observation well is provided that gives the well location, site identification number, hydrologic unit, owner, aquifer, well characteristics, general remarks, period of record, and extreme measurements for the period of record. A hydrograph for the period of record is presented for each well. The method and frequency of water-level measurements at each well are presented in tabular format. (USGS)
W86-02996

LOW-FLOW CHARACTERISTICS OF KENTUCKY STREAMS, 1983,
Geological Survey, Louisville, KY. Water Resources Div.
J. N. Sullavan.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-705, 1984. 1 p, 1 map, 2 tab, 3 ref.

Descriptors: *Streamflow, *Low flow, *Kentucky, Data collections, Hydrologic data.

Low-flow data at 84 continuous-record sites and the 7-day 2-year and 7-day 10-year flow at 204 partial-record sites in Kentucky are presented. The station identifier, 7-day 10-year discharge in cubic feet per second and the drainage area in square miles are shown on the map. Other data are shown in tabular form. (USGS)
W86-02998

INDEX OF GROUND-WATER QUALITY DATA FOR FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. R. Seaber, and O. O. Williams.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-177, 1985. 478 p, 9 fig, 12 tab, 33 ref.

Descriptors: Groundwater, *Groundwater quality, *Chemical analysis, Water quality, *Indexing, *Information retrieval, Hydrologic data, Aquifers, Geochemistry, Water quality management, Water sampling, *Florida, Water quality data index.

The Master Water Data Index of the U.S. Geological Survey contains records and information for 13,925 ground-water quality collection sites in Florida as follows: 2,180 active and 11,559 inactive well sites, and 39 active and 147 inactive spring sites. Ground-water quality data have been and are being collected at more sites in Florida than are other types of ground- and surface-water hydrologic data. Information available from the Master Water Data Index includes location (county, hydrologic unit, and latitude-longitude); reporting agency; agency identifying number; period and frequency of record; types of data (parameter sampled); and for wells, the principal aquifer sampled and well depth. This information may be retrieved, upon request, in a variety of formats. This report contains an index of the information available, not the actual water-quality data itself. The actual data may be obtained from the reporting agency that collected and stored the data. (USGS)
W86-03002

MAP SHOWING OUTCROPS OF GRANITIC ROCKS, ASH-FLOW TUFF, AND LAHARIC BRECCIA, BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
K. A. Sargent, and J. E. Jenness.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4117-C, 1984. 7 p, 1 tab, 22 ref.

Descriptors: *Granitic rocks, Ash-flow tuff, Laharic breccia, Geology, *Maps, Hydrogeology, Basin and Range Province, *Idaho.

Outcrops of granitic rocks, ash-flow tuff, and laharic breccia have been delineated within the Basin and Range Province of Idaho as part of a study by the U.S. Geological Survey to evaluate possible repository rocks for disposal of high-level radioactive waste within the Basin and Range Province, western United States. The distribution, lithologic character, geologic age, thickness (where appropriate), the sources of data of the geologic units are described. (USGS)
W86-03005

HYDROGEOLOGIC DATA RELATED TO THE POTENTIAL FOR STOCK-WATER DEVELOPMENT ON FEDERALLY OWNED RANGELAND NEAR DILLON, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. F. Levings.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 85-170, 1985. 22 p, 1 pl, 11 ref.

Descriptors: Groundwater potential, Aquifer evaluation, On-site investigations, *Hydrologic data, Site selection, *Potential water supply, Data collections, Dillon, *Montana, Beaverhead County.

Existing hydrogeologic data and information were synthesized for 20 sites on federally owned rangeland near Dillon, Montana. The purpose was to assist the U.S. Bureau of Land Management in evaluating the potential for developing additional stock-water supplies. Hydrologic and geologic conditions at most of the sites were verified by onsite inspection during the summer of 1984. Each site is described in terms of location, altitude of land surface, inferred aquifer(s), estimated depth to water, estimated drilling depth, estimated yield, estimated dissolved-solids concentration, hydrogeologic setting, and development. A plate shows the location of wells and springs, dissolved-solids concentrations and chemical-constituent diagrams for water samples, ownership status for selected rangeland areas near Dillon. (USGS)
W86-03016

WATER-RESOURCES APPRAISAL OF THE UPPER ARKANSAS RIVER BASIN FROM LEADVILLE TO PUEBLO, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03025

COMPILATION OF GROUND WATER QUALITY DATA IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. L. Barker.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-706, 1984. 102 p, 39 fig, 32 tab, 24 ref.

Descriptors: *Groundwater, *Water quality, Well water, Groundwater pollution, *Geohydrologic units, Geology, Geologic formations, Hydrogeology, *Pennsylvania, *Hydrologic data.

The U.S. Geological Survey's water-quality file of 4,671 wells and springs in Pennsylvania provided the basis for a statistical appraisal of ground-water quality data in Pennsylvania. The data was assembled into computer readable format and sorted into 15 major aquifer groups based on principal lithology, physiographic province, and age. Nineteen variables in each group were analyzed by the Statistical Analysis Systems UNIVARIATE procedure to produce descriptive statistics including detail on the extreme values, quartiles, frequency distribution plots, and tables. Water-quality data are available for the important acquifers in the unconsolidated Coastal Plain sediments, the Triassic sedimentary rocks, the igneous and metamorphic rocks, and the carbonate rocks. On the other hand, water-quality data for aquifer groups in the Appalachian Plateau and Valley and Ridge Province are generally sparse. Statewide, only six wells provide sufficient long-term data for trend analysis. Water quality in Pennsylvania is highly variable. High concentrations of dissolved solids, iron, manganese, sulfate, and nitrate are prevalent forms of natural and manmade contamination. The unconsolidated Coastal Plain aquifers have been most severely degraded. On the other hand, some of the best quality water is found in the quartzite, sandstone, and conglomerate rock units in thee Cambrian and Precambrian rocks. (USGS)
W86-03026

POTENTIOMETRIC SURFACES ON LONG ISLAND, NEW YORK–A BIBLIOGRAPHY OF MAPS,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Smolensky.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-070, 1983. 31 p, 9 fig, 1 tab, 19 ref.

Descriptors: *Potentiometric level, Water table, Groundwater movement, Water-level fluctuations, *Maps, *Bibliographies, Nassau County, Suffolk County, Kings County, Queens County, Long Island, *New York, *Long Island (NY).

Historic water-level records form a major basis for ground-water investigations and water-management decisions on Long Island. Potentiometric-surface maps, one of the major sources of historic data, are scattered within the literature or are available only through the publisher or sponsoring agency. This report presents a comprehensive list of available water-table and potentiometric-surface maps from the 19th century through 1979 with the scale, years represented, and area depicted; complete bibliographic citations are included to facilitate retrieval. The bibliography is preceded by a summary of the hydrologic system and a short history of ground-water development on Long Island, with emphasis on the effects of urbanization as reflected in ground-water levels. A series of six water-table maps from before 1900 through 1979 is presented to illustrate the major historic ground-water trends. (USGS)
W86-03030

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO 1983,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-720, 1984. 25 p, 14 fig, 6 tab, 3 ref.

Descriptors: *Hydrologic data, Groundwater, Potentiometric level, Water quality, Slope-area measurement, Peak flow, White Sands Missile Range, *New Mexico.

Ground-water data were collected at White Sands Missile Range in 1983. The total amount of water pumped from White Sands Missile Range supply wells in 1983 was 713,557,500 gallons. The Post Headquarters well field accounted for 686,499,200 gallons of the total. Seasonal water-level fluctuations in the supply wells ranged from a 3.00-foot rise in Stallion Range Well-2 (SRC-2) to a 51.00 foot decline in Post headquarters supply well 11 (SW-11). All of the test wells and observation

wells up to 2 miles east of the Post Headquarters well field showed a decline for the period 1973-1983. Only one test well and one borehole west of the Post Headquarters well field showed a decline in water level; the other five showed a rise in water level for the period 1973-1983. (USGS)
W86-03031

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON, COS., TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03045

GROUND-WATER LEVELS IN WYOMING, 1974 THROUGH 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03046

WATER-QUALITY DATA FOR 34 SITES, APRIL AND JUNE, 1984, NEAR THE Y-12 PLANT, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03048

WATER BUDGET FOR MAJOR STREAMS IN THE CENTRAL VALLEY, CALIFORNIA, 1961-77,
Geological Survey, Tahoe City, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03050

SUMMARY OF WATER-RESOURCES ACTIVITIES OF THE UNITED STATES DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY-FISCAL YEAR 1984, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03067

SELECTED HYDROGEOLOGIC DATA FOR THE BIG MUDDY CREEK VALLEY NEAR PLENTYWOOD, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W86-03068

GEOHYDROLOGIC SECTIONS, NORTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
C. D. Whiteman, and A. Martin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Rresources Investigations Map Report 84-4211, 1984. 1 p, 3 fig, 1 tab, 15 ref.

Descriptors: *Geohydrologic sections, *Aquifer systems, Cenozoic era, *Cross-sections, *Regional analysis, Geohydrology, Maps, *Louisiana, *Mississippi embayment, West Gulf Coastal Plain, *RASA.

Two geohydrologic sections in northern Louisiana were mapped as an initial step to define the flow paths of water in major aquifer systems. This effort is part of the Regional Aquifer System Analysis (RASA) program. One section is a strike along the western part of the Mississippi embayment and the other is a dip section across the Monroe uplift and the western part of the Mississippi embayment. In northern Louisiana, major aquifer systems and confining beds correspond closely to hydrologically as a single confining bed subdividing the Cenozoic sediments into two major aquifer systems. The lower major aquifer system consists of three aquifers--the Wilcox-Carrizo, the Sparta, and the Cockfield--and two confining beds--the Cane River and Cook Mountain Formations. The upper major aquifer system comprises all of the sediments above the clays of the Jackson and Vicksburg Groups. To the north the upper aquifer system serves as a source of recharge to the lower aquifer system. Southward and eastward both aquifer systems are isolated from each other, thicken, and are the sources of freshwater supply throughout much of central and southern Louisiana. (USGS)
W86-03083

ALTITUDE OF WATER TABLE, SURFICIAL AQUIFER, PALM BEACH COUNTY, FLORIDA, APRIL 24-26, 1984,
Geological Survey, Miami, FL. Water Resources Div.
W. L. Miller.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-336, 1985. 1 p (map), 1 fig.

Descriptors: *Water levels, *Water-level fluctuations, *Florida, Palm Beach County, Surficial aquifer.

Water levels in Palm Beach County, Florida, were measured in April 1984 to determine the altitude of the water table in the surficial aquifer. A total of 104 wells and 50 surface-water measurement sites were used to contour the altitude of the water table at 2 and 4-foot intervals. The water-level measurements made in April represent low-water levels near the end of south Florida's dry season. Contours of the water table at this time ranged from 22 feet above sea level in the north-central part of the county to 2 feet near the coast. (USGS)
W86-03085

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1985,
Geological Survey, Orlando, FL. Water Resources Div.
G. R. Schiner, and E. C. Hayes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report (Map) 85-491, 1985. 1 sheet (map).

Descriptors: *Potentiometric surface, *Groundwater, Hydrologic aspects, Aquifers, Hydrogeology, Water levels, *Florida, St. Johns River Water Management District.

This map shows the potentiometric surface of the Upper Floridan aquifer in the St. Johns River Water Management District and vicinity for May 1985. The Upper Floridan aquifer is the principal source of potable water in the area. Water-level measurements were made on approximately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area of Nassau County a 30-foot interval is used to show a deep cone of depression. The potentiometric surface ranged from 125 feet above sea level in Polk County to 74 feet below sea level in Nassau County. Water levels in key wells ranged from 1 to 8 feet below average for May in response to lack of rainfall and an attendant increase in pumpage. Many levels in the district were considerably below the levels of May 1984. Declines of 5 to 7 feet from May 1984 levels were common in the western and northern parts of the district. However, the largest declines from May 1984 levels were mostly in well fields along the coastline. Levels in some wells reached record lows. (USGS)
W86-03095

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, SEPTEMBER 1984,
Geological Survey, Orlando, FL. Water Resources Div.
G. R. Schiner, and E. C. Hayes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open File Report (Map) 84-865, 1984. 1 sheet (map).

Descriptors: *Potentiometric suface, *Groundwater, Hydrologic aspects, Aquifers, Hydrogeology, Water levels, *Florida, St. Johns River Water Management District.

This map shows the potentiometric surface of the Upper Floridan aquifer in the St. Johns River Water Management District and vicinity for September 1984. The Upper Floridan aquifer is the principal source of potable water in the area. Water-level measurements were made on approximately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area of Nassau County a 40-foot interval is used to show a deep cone of depression. The potentiometric surface ranged from 130 feet above sea level in Polk County to 83 feet below sea level in Nassau County. Water levels in key wells ranged from slightly above average to several feet below average for September in response to diverse area rainfall patterns. Most levels in the district were about the same as the levels of September 1983. However, in Nassau County levels were generally below those of September 1983, and levels in Volusia County were mostly higher than September 1983 levels. (USGS)
W86-03096

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER SYSTEM IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1984,
Geological Survey, Orlando, FL. Water Resources Div.
G. R. Schiner, and E. C. Hayes.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report (Map) 84-801, 1984. 1 sheet (map).

Descriptors: *Potentiometric surface, *Groundwater, Hydrologic aspects, Aquifer, Hydrogeology, Water levels, *Florida, St. Johns River Water Management District.

This map shows the potentiometric surface of the Upper Floridan aquifer in the St. Johns River Water Management District and vicinity for May 1984. The Upper Floridan aquifer is the principal source of potable water in the area. Water-level measurements were made on approximately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area a 40-foot interval is used to show a deep cone of depression. The potentiometric surface ranged from 126 feet above sea level in Polk County to 84 feet below sea level in Nassau County. Water levels in key wells were mostly above, or less frequently, slightly below averages for May in response to diverse area rainfall patterns. Most levels in the district were about the same, or more commonly, 1 to 2 feet lower than May 1983 levels. (USGS)
W86-03097

URBAN WATER-QUALITY DATA AND STATISTICAL SUMMARIES FOR SELECTED SITES IN THE SHUNGANUNGA CREEK BASIN, TOPEKA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03099

MAY 1984-APRIL 1985 WATER BUDGET OF REELFOOT LAKE WITH ESTIMATES OF SEDIMENT INFLOW AND CONCENTRATIONS OF PESTICIDES IN BOTTOM MATERIAL IN TRIBUTARY STREAMS--BASIC DATA REPORT,
Geological Survey, Nashville, TN. Water Re-

sources Div.
For primary bibliographic entry see Field 5B.
W86-03100

HYDROGRAPHS FROM SELECTED OBSERVATION WELLS AND TOTAL ANNUAL PUMPAGE FROM MUNICIPAL SUPPLY WELLS, 1950-83, SANTA FE, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
S. F. Richey.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-152, 1985. 1 sheet (map), 1 fig.

Descriptors: *Water level fluctuations, *Well hydrographs, Municipal water, *Water use, Groundwater levels, Santa Fe, *New Mexico, *Maps.

Total annual pumpage from seven municipal supply wells for 1950-83 is depicted by a bar graph. Water-level hydrographs for 16 observation wells located throughout the Santa Fe metropolitan area are shown. The period of record for the observation wells is variable; the longest is from 1951 to 1984. All wells are located on a map of the Santa Fe area. (USGS)
W86-03101

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1982,
Geological Survey, Austin, TX. Water Resources Div.
F. Liscum, J. P. Bruchmiller, J. S. Hutchison, and E. M. Paul.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-407, 1985. 252 p, 20 fig, 19 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, Streamflow, *Texas, *Hydrologic data, Data collections, *Urban hydrologic, *Houston, San Jacinto River basin.

This report contains rainfall and runoff data collected during the 1982 water year for drainage basins in the Houston, Texas, metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Rainfall-runoff computations are presented for 16 storm periods during the 1982 water year. (USGS)
W86-03106

GENERALIZED POTENTIOMETRIC SURFACE OF THE EVANGELINE AND EQUIVALENT AQUIFERS IN LOUISIANA, 1980,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. Martin, and C. D. Whiteman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4359, 1985. 1 sheet (map), 1 fig, 1 tab, 13 ref.

Descriptors: *Water levels, *Aquifers, *Aquifer systems, Artesian aquifers, Water table, *Louisiana, Pliocene age, Miocene age, West Gulf Coastal Plain, *RASA, Evangeline aquifer, Chicot aquifer, *Maps.

A generalized potentiometric-surface map defines the altitude of water levels for 1980 in wells in the Evangeline aquifer in southwestern Louisiana and stratigraphically equivalent aquifers in southeastern Louisiana. The Evangeline and equivalent aquifers increase in thickness from zero at the northern edge of the outcrop/subcrop belt to more than 2,000 feet along the southern limit of fresh water. The aquifers are recharged by rainfall on the overlying upland terrace deposits of south-central Louisiana, southeastern Louisiana, and southwestern Mississippi. The aquifers are under artesian conditions except locally in the recharge areas. The regional flow direction is primarily southward. Water levels in wells in the Evangeline aquifer are lowered by heavy pumping from the overlying Chicot aquifer in Evangeline and Acadia Parishes. Areally definable cones of depression result from pumpage from the Evangeline and equivalent aquifers in and near Baton Rouge, Eunice, and Ville Platte. Water levels may differ vertically within the aquifer near pumping centers. The map does not account for localized distortion of the regional flow pattern near these centers. (USGS)
W86-03107

HYDROLOGIC DATA FOR THE LARIMER-WELD REGIONAL WATER-MONITORING PROGRAM, COLORADO, 1975-1982,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03110

HYDROGEOLOGIC DATA FROM THE U.S. GEOLOGICAL SURVEY TEST WELLS NEAR WAYCROSS, WARE COUNTY, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03113

HYDROLOGIC-DATA STATIONS AND LAKE LEVELS, KENAI-NIKISKI AREA, ALASKA, 1983,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03115

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
USGS Open-File Report 83-935, 1983. 6 p, 1 fig (map), 7 ref.

Descriptors: *Satellite technology, *Remote sensing, Geologic faults, Geologic joints, *Mass, *Linear trends, *Lineaments, *Northern Great Plains, Regional aquifers, Landsat imagery, *Wyoming.

The report consists of a map (scale 1:500,000) that shows the linear features determined from Landsat imagery in Wyoming. The linear features, sometimes called linear trends or lineaments, are not identified as to type or origin. Most probably represent fractures or fracture zones, which may affect the movement of water or other fluids through the rocks. The linear features are classified as to length--less than 30 miles, 30 to 200 miles, 200 to 500 miles, and more than 500 miles. (USGS)
W86-03120

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1984,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03130

GENERALIZED THICKNESS AND CONFIGURATION OF THE TOP OF THE INTERMEDIATE AQUIFER, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03137

GROUND-WATER DATA FOR GEORGIA, 1983,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03139

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN NORTH DAKOTA,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
USGS Open-File Report 83-937, 1983. 6 p, 1 fig (map), 7 ref.

Descriptors: *Satellite technology, *Remote sensing, Geologic faults, Geologic joints, *Maps, *Linear trends, *Lineaments, *Northern Great Plains, Regional Aquifer System Analysis, Landsat imagery, High Plains, North Dakota.

The report consists of a map (scale 1:500,000) that shows the linear features determined from Landsat imagery in North Dakota. The linear features, sometimes called linear trends or lineaments, are not identified as to type or origin. Most probably represent fractures or fracture zones, which may affect the movement of water or other fluids through the rocks. The linear features are classified as to length--less than 30 miles, 30 to 200 miles, 200 to 500 miles, and more than 500 miles. (USGS)
W86-03144

WATER RESOURCES DATA, ALASKA WATER YEAR 1981.
Geological Survey, Anchorage, AK. Water Resources Div.
USGS Water-Data Report AK-81-1, 1982. 395 p, 4 fig, 1 tab. Prepared in cooperation with the State of Alaska and with other agencies.

Descriptors: *Alaska, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1981 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 121 gaging stations; stage only record for 1 gaging station; water quality for 63 stations; and water levels for 30 observation wells. Also included are 50 low-flow, 71 crest-stage, and 20 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (USGS)
W86-03146

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, AND RIO GRANDE BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
R. C. Ugland, J. T. Steinheimer, J. L. Blattner, and R. D. Steger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-123859, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report CO-83-1, 1984. 379 p, 6 fig, 6 tab. Prepared in cooperation with the State of Colorado and with other agencies.

Descriptors: *Colorado, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for Colorado for the 1983 water year consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for 400 gaging stations, stage and contents of 23 lakes and reservoirs, 6 partial-record low-flow stations, peak flow information for 19 crest-stage partial-record stations, and 20 miscellaneous sites; water quality for 132 gaging stations and 291

miscellaneous sites; and water levels for 55 observation wells. Six pertinent stations in bordering States also are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of J. F. Blakey, District Chief. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03147

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
J. T. Steinheimer, R. C. Ugland, H. E. Burch, and E. A. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-210946, Price codes: A12 in paper copy, A01 in microfiche. USGS Water-Data Report CO-83-3, 1984. 270 p, 6 fig, 6 tab. Prepared in cooperation with the State of Colorado and with other agencies.

Descriptors: *Colorado, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for Colorado for the 1983 water year consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for 400 gaging stations, stage and contents of 23 lakes and reservoirs, 6 partial-record low-flow stations, peak flow information for 19 crest-stage partial-record stations, and 20 miscellaneous sites; water quality for 132 gaging stations and 291 miscellaneous sites; and water levels for 55 observation wells. Six pertinent stations in bordering States also are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of J. F. Blakey, District Chief. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03148

WATER RESOURCES DATA, COLORADO WATER YEAR 1983, VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
R. C. Ugland, J. T. Steinheimer, J. L. Blattner, and R. G. Kretschman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-123867, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report CO-83-2, 1984. 287 p, 6 fig, 6 tab. Prepared in cooperation with the State of Colorado and with other agencies.

Descriptors: *Colorado, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for Colorado for the 1983 water year consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for 400 gaging stations, stage and contents of 23 lakes and reservoirs, 6 partial-record low-flow stations, peak flow information for 19 crest-stage partial-record stations, and 20 miscellaneous sites; water quality for 132 gaging stations and 291 miscellaneous sites; and water levels for 55 observation wells. Six pertinent stations in bordering States also are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of J. F. Blakey, District Chief. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03149

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 1. CENTRAL AND NORTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
D. D. Carlson, G. R. Stallworth, L. J. Dantin, and C. L. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127751, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report LA-83-1, 1983. 392 p, 18 fig. Prepared in cooperation with the State of Louisiana and with other agencies.

Descriptors: *Louisiana, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report, in two volumes, contains records for water discharge at 79 gaging stations (including stage for 69 of these stations); stage only for 50 gaging stations and 11 lakes; contents for 1 reservoir; water quality for 110 surface-water stations (including 33 gaging stations), 10 miscellaneous sites, 12 lakes, and 213 wells; and water levels for 679 observation wells. Also included are data for 195 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (USGS)
W86-03150

WATER RESOURCES DATA, LOUISIANA WATER YEAR 1983, VOLUME 2, SOUTHERN LOUSIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
D. D. Carlson, G. R. Stallworth, L. J. Dantin, and C. L. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-169985/AS, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report LA-83-2, 1983. 360 p, 26 fig. Prepared in cooperation with the State of Louisiana and with other agencies.

Descriptors: *Louisiana, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report, in two volumes, contains records for water discharge at 79 gaging stations (including stage for 69 of these stations); stage only for 50 gaging stations and 11 lakes; contents for 1 reservoir; water quality for 110 surface-water stations (including 33 gaging stations), 10 miscellaneous sites, and 12 lakes, and 213 wells; and water levels for 679 observation wells. Also included are data for 195 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (USGS)
W86-03151

WATER RESOURCES DATA, NEW MEXICO WATER YEAR 1983,
Geological Survey, Albuquerque, NM. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-169902/AS, Price codes: A22 in paper copy, A01 in microfiche. USGS Water-Data Report NM-83-1, 1984. 525 p, 8 fig, 2 tab. Prepared in cooperation with the State of New Mexico and with other agencies.

Descriptors: *New Mexico, *Hydrologic data, *Surface water, *Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water analyses, Groundwater levels, *Data collections.

Water-resoures data for the 1983 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 178 gaging stations; stage and contents for 25 lakes and reservoirs; water quality for 78 gaging stations; and 87 observation wells. Also included are 139 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in New Mexico. (USGS)
W86-03152

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1982, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
A. Voytik, T. E. White, D. W. Speight, and K. P. Gillepsie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-161579, Price codes: A12 in paper copy, A01 in microfiche. USGS Water-Data Report PA-82-1, 1982. 252 p, 9 fig. Prepared in cooperation with the State of Pennsylvania and with other agencies.

Descriptors: *Pennsylvania, *Hydrologic data, *Groundwater, *Surface waters, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, Water wells, *Data collections, Sites.

Water-resources data for the 1982 water year for Pennsylvania consist of records of discharge and water quality of streams; elevation and contents of lakes and reservoirs; and elevation of tides; and water levels of ground-water wells. This volume contains records for water discharge at 66 gaging stations; elevation and contents at 11 lakes and reservoirs; elevation of tides at 1 gaging stations; water quality at 33 gaging stations; and water levels at 16 observation wells. Also included are data for 34 crest-stage, 80 low-flow, and 43 water-quality partial-record stations. Locations of these sites are shown on figures 6 through 9. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. (USGS)
W86-03153

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 1. DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.

T. E. White, D. W. Speight, K. P. Gillespie, and R. L. Druther.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-210920, Price codes: A12 in paper copy, A01 in microfiche. USGS Water-Data Report PA-83-1, 1984. 261 p, 9 fig. Prepared in cooperation with the State of Pennsylvania and with other agencies.

Descriptors: *Pennsylvania, *Hydrologic data, *Groundwater, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, Water wells, *Data collections, Sites.

Water-resources data for the 1983 water year for Pennsylvania consist of records of discharge and water quality of streams; elevation and contents of lakes and reservoirs; and elevation of tides; and water levels of ground-water wells. This volume contains records for water discharge at 68 gaging stations; elevation and contents at 11 lakes and reservoirs; elevation of tides at 5 gaging stations; water quality at 33 gaging stations; and water levels at 16 observation wells. Also included are data for 33 crest-stage, 62 low-flow, and 43 water-quality partial-record stations. Location of these sites are shown on figures 6 through 9. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local and Federal agencies in Pennsylvania. (USGS)
W86-03154

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 2. SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. W. Buchanan, W. C. Loper, W. P. Schaffstall, and R. A. Hainly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128007, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report PA-83-2, 1984. 283 p, 10 fig. Prepared in cooperation with the State of Pennsylvania and with other agencies.

Descriptors: *Pennsylvania, *Hydrologic data, *Groundwater, *Surface waters, *Water Quality, Gaging Stations, Streamflow, Flow Rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, Water wells, Data collections, Sites.

Water-resources data for the 1983 water year for Pennsylvania consist of records of discharge and water quality of streams; contents of lakes and reservoirs; and water levels, and water quality of ground-water wells. This volume contains records for water discharge at 84 stations; contents at 13 lakes and reservoirs, water quality at 18 gaging stations; and water levels at 26 network observation wells. Also included are data for 12 crest-stage, 98 low flow, and 3 water-quality, and 85 ground water-quality partial-record stations. Locations of these sites are shown on figures 7-10. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analysis. These data together with the data in Volumes 1 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (USGS)
W86-03155

WATER RESOURCES DATA, PENNSYLVANIA WATER YEAR 1983, VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. B. Lescinsky, M. B. Coll, and R. W. Siwicki.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128015, Price codes: A09 in paper copy, A01 in microfiche. USGS Water-Data Report PA-83-2, 1984. 183 p, 5 fig. Prepared in cooperation with the State of Pennsylvania and with other agencies.

Descriptors: *Pennsylvania, *Hydrologic data, *Groundwater, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, Water wells, *Data collections, Sites.

Water-resources data for the 1983 water year for Pennsylvania consist of records of discharge and water quality of streams; elevation and contents of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 83 gaging stations; elevations and contents at 3 lakes and reservoirs; and water levels at 31 observation wells. Also included are data for 3 crest-stage and 5 low-flow stations. Locations of these sites are shown on figures 4 and 5. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analysis. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local and Federal agencies in Pennsylvania. (USGS)
W86-03156

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 2. LONG ISLAND,
Geological Survey, Syosset, NY. Water Resources Div.
A. G. Spinello, J. H. Nakao, W. J. Flipse, and J. G. Carcaci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127983, Price codes: A11 in paper copy, A01 in microfiche. USGS Water-Data Report NY-83-2, 1984. 248 p, 14 fig, 1 tab. Prepared in cooperation with the State of New York and with other agencies.

Descriptors: *New York, *Hydrologic data, *Groundwater, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, Water wells, *Data collections, Sites.

Water-resources data for the 1983 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water quality of precipitation; and water levels and water quality of ground water wells. This volume contains records for water discharge at 17 gaging stations; water quality at 17 gaging stations, 647 wells; and water levels at 136 observation wells. Also included are data for 79 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey in cooperation with State, Federal, and other agencies in New York. (USGS)
W86-03157

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 3. WESTERN NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
J. B. Hood, W. H. Johnston, H. J. Zajd, and H. L. Dixson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127991, Price codes: A10 in paper copy, A01 in microfiche. USGS Water-Data Report NY 83-3, 1984. 206 p, 5 fig, 1 tab. Prepared in cooperation with the State of New York and with other agencies.

Descriptors: *New York, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Streamflow, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water analysis, Water temperature, Water levels, Water wells, *Data collections, Sites, Seepage investigations.

Water-resources data for the 1983 water year for New York consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 84 gaging stations; stage only at 14 gaging stations; stage and contents at 6 gaging stations; water quality at 14 gaging stations; and water levels at 20 observation wells. Also included are data for 63 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and seepage investigations. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W86-03158

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 1, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
S. S. Chinn, G. A. Tateishi, and J. J. S. Yee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-125623. Price codes: A11 in paper copy, A01 in microfiche. USGS Water-Data Report HI-83-1, 1984. 243 p, 14 fig. Prepared in cooperation with the State of Hawaii and with other agencies.

Descriptors: *Hawaii, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Hawaii and other Pacific Areas consist of records of stage, discharge, and water quality of streams and springs; and water levels and water quality in wells. This report, volume 1, contains discharge records for 97 gaging stations; water quality for 13 gaging stations, 92 partial-record flow stations, and 159 wells; and water levels for 24 observation wells. Also included are 108 crest-stage partial-record stations and 24 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other agencies in Hawaii. (USGS)
W86-03159

WATER RESOURCES DATA, HAWAII AND OTHER PACIFIC AREAS WATER YEAR 1983. VOLUME 2,
Geological Survey, Honolulu, HI. Water Resources Div.
S. S. Chinn, G. A. Tateishi, and J. J. S. Yee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127769, Price codes: A08 in paper copy, A01 in microfiche. USGS Water-Data Report HI-83-2, 1984. 162 p, 15 fig. Prepared in cooperation with the Governments of Guam, Northern Mariana Islands, Federated States of Micronesia, Palau Islands, American Samoa, and with other agencies.

Descriptors: *Pacific area, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Chemical analyses, Sediments, Reservoirs, Water temperatures, Sampling sites, Water levels, *Data collections.

Volume 2 of the water-resources data for the 1983 water year for other Pacific areas consist of records of stage, discharge, and water quality of streams and springs; stage of a lake and a reservoir; and water levels and water quality in wells. This

report contains discharge records for 37 gaging stations; stage only record for 2 gaging stations; water quality for 9 gaging stations; 12 partial-record stations; water temperature for 36 gaging stations; and water levels for 30 observation wells and water quality for 78 ground-water sites. Also included are 43 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Governments and Federal agencies in other Pacfic areas. (USGS)
W86-03160

WATER RESOURCES DATA, KENTUCKY WATER YEAR 1983,
Geological Survey, Louisville, KY. Water Resources Div.
J. M. Bettandorff, N. B. Melcher, D. W. Leist, and D. V. Whitesides.
USGS Water-Data Report KY-83-1, 1984. 519 p, 12 fig, 3 tab. Prepared in cooperation with the State of Kentucky and with other agencies.

Descriptors: *Kentucky, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Gaging stations, Streamflow, Flow rates, Lakes, Wells, Chemical analyses, Suspended sediments, Water temperature, Water levels, *Data collections.

Water-resources data for the 1983 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records from 108 gaging stations; stage and contents for 15 lakes; suspended-sediment data for 34 stations (10 daily); daily temperature records for 17 stations, daily specific conductance for 10 stations; groundwater levels for 72 continuous-record wells and 104 partial-record wells; water-quality data from 27 surface-water stations sampled at regular intervals, and from 60 wells and 16 springs; and miscellaneous temperature and specific conductance data from 107 gaging stations. Also included are data from 102 partial-record crest-stage sites. Data collected at various miscellaneous sites are also published. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (USGS)
W86-03161

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY FOR THE RICHFIELD 1 DEG. BY 2 DEG. QUADRANGLE AND ADJACENT PART OF SOUTHWESTERN UTAH,
M. E. Cooley.
USGS Open-File Report (Map) 83-934, 1984. 4 p, 1 fig (map), 4 ref.

Descriptors: *Satellite technology, *Remote sensing, Geologic faults, Geologic joints, *Maps, *Linear trends, Lineaments, Landsat imagery, *Colorado Plateau, Basin and Range Province, Utah.

The report consists of a map (scale 1:500,000) that shows the linear features determined from Landsat imagery in southwestern Utah. The area extends across the boundary between the Colorado Plateau and the Basin-and-Range physiographic provinces. The linear features, sometimes called linear trends or lineaments, are not identified as to type or origin. Most probably represent fractures or fracture zones, which may affect the movement of water or other fluids through the rocks. (USGS)
W86-03165

INDEX OF HYDROLOGIC DATA FOR SELECTED SITES IN DADE COUNTY, FLORIDA, 1923-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03175

DESCRIPTIVE, GEOLOGIC, AND BOREHOLE GEOPHYSICAL LOGS FOR 23 TEST HOLES IN SOUTH-CENTRAL NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03176

DRAINAGE AREAS IN NEW JERSEY: ATLANTIC COASTAL BASINS, SOUTH AMBOY TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03178

WATER RESOURCES DATA, SOUTH DAKOTA WATER YEAR 1983,
Geological Survey, Huron, SD. Water Resources Div.
E. B. Hoffman, N. F. Leibbrand, D. R. Winter, and R. D. Benson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127850, Price codes: A12 in paper copy, A01 in microfiche. USGS Water-Data Report SD-83-1, 1984. 269 p, 7 fig, 5 tab. Prepared in cooperation with the State of South Dakota and with other agencies.

Descriptors: *South Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for South Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 107 gaging stations, stage and contents for 13 lakes and reservoirs; water quality for 26 gaging stations; and water levels for 7 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Dakota. (USGS)
W86-03179

WATER RESOURCES DATA, TENNESSEE WATER YEAR 1983,
Geological Survey, Nashville, TN. Water Resources Div.
J. F. Lowers, P. H. Counts, H. L. Edmiston, and F. D. Edwards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127462, Price codes: A15 in paper copy, A01 in microfiche. USGS Water-Data Rept TN-83-1, 1984. 327 p, 6 fig, 1 tab. Prepared in cooperation with the Tennessee Dept of Health and Environment, Div of Water Management; Tennessee Valley Authority; and other State, municipal, and Fed agencies.

Descriptors: *Tennessee, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment analyses, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Tennessee consist of records of stage, discharge, and water quality of streams and springs; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 96 gaging stations; stage only records for one lake gaging station; elevation and contents for 28 lakes and reservoirs; water quality for 25 stations and 49 wells; and water levels for 33 observation wells. Also included are 116 crest-stage partial-record stations and 83 low-flow partial-record stations. Additional water data were collected at various stream and spring sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses, or as seepage investigations of discharge and water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Tennessee. (USGS)
W86-03180

WATER RESOURCES DATA, IDAHO WATER YEAR 1983,
Geological Survey, Boise, ID. Water Resources Div.
R. W. Harper, H. G. Sisco, I. O'Dell, and S. C. Cordes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-169555/AS, Price codes: A22 in paper copy, A01 in microfiche. USGS Water-Data Report ID-83-1, 1984. 515 p, 30 fig, 3 tab. Prepared in cooperation with the State of Idaho and with other agencies.

Descriptors: *Idaho, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 170 gaging stations; stage only records for 2 gaging stations; stage only for 8 lakes and reservoirs; contents only for 17 lakes and reservoirs; water quality for 21 gaging stations and 37 wells; and water levels for 433 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho, adjacent States, and Canada. (USGS)
W86-03181

WATER RESOURCES DATA, IOWA WATER YEAR 1983,
Geological Survey, Iowa City, IA. Water Resources Div.
I. L. Burmeister, V. L. Spiers, P. J. Soenksen, and W. J. Matthes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-126019, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report IA-83-1, 1984. 292 p, 12 fig, 2 tab. Prepared in cooperation with the State of Iowa and with other agencies.

Descriptors: *Iowa, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Streamflow, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Sampling sites, Water levels, Water analyses, *Data collections, Water wells.

Water-resources data for the 1983 water year for Iowa consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 116 gaging stations; stage and contents for 7 lakes and reservoirs; water quality for 17 gaging stations; and water levels for 90 observation wells. Also included are 125 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Iowa. (USGS)
W86-03182

WATER RESOURCES DATA, KANSAS WATER YEAR 1983,

Geological Survey, Lawrence, KS. Water Resources Div.
C. O. Geiger, D. L. Lacock, L. R. Shelton, M. L. Penny, and C. E. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-167740/AS, Price codes: A21 in paper copy, A01 in microfiche. USGS Water-Data Report KS-83-1, 1984. 483 p, 8 fig, 6 tab. Prepared in cooperation with the State of Kansas and with other agencies.

Descriptors: *Kansas, Sampling sites, *Hydrologic data, *Surface water, *Groundwater, Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water level, Water analysis, *Data collections.

Water-resources data for the 1983 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge records for 141 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 52 gaging stations; and water levels for 471 observation wells and water quality for 212 wells. Also included are data for 91 crest-stage partial-record stations. All data in this report represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (USGS)
W86-03183

WATER RESOURCES DATA, GEORGIA WATER YEAR 1983,
Geological Survey, Doraville, GA. Water Resources Div.
W. R. Stokes, T. W. Hale, J. L. Pearman, and G. R. Buell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-168748/AS, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report GA-83-1, 1984. 365 p, 7 fig, 1 tab. Prepared in cooperation with the State of Georgia and with other Federal agencies.

Descriptors: *Georgia, Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Wells, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Georgia consist of records of state, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records of 104 gaging stations; stage for 11 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 14 continuous stations, 107 periodic stations and miscellaneous sites; peak stage and discharge only for 122 crest-stage partial-record stations and 4 miscellaneous sites; and water levels of 28 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Georgia. (USGS)
W86-03184

WATER RESOURCES DATA, NEW JERSEY WATER YEAR 1983, VOLUME 1: ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
W. R. Bauersfeld, E. W. Moshinsky, E. A. Pustay, and F. L. Schaefer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127330, Price codes: A14 in paper copy, A01 in microfiche. USGS Water-Data Report NJ-83-1, 1984. 320 p, 7 fig, 3 tab. Prepared in cooperation with the New Jersey Department of Environmental Protection and with other agencies.

Descriptors: *New Jersey, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 80 gaging stations; tide summaries for 1 station; stage and contents for 15 lakes and reservoirs; water quality for 68 surface-water sites and 82 wells; and water levels for 50 observation wells. Also included are data for 41 crest-stage partial-record stations, 17 tidal crest-stage gages, and 47 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W86-03185

WATER RESOURCES DATA, NEW YORK WATER YEAR 1983, VOLUME 1: EASTERN NEW YORK EXCLUDING LONG ISLAND,
Geological Survey, Albany, NY. Water Resources Div.
R. Lumia, P. M. Burke, R. J. Archer, and F. N. Dalton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127975, Price codes: A11 in paper copy, A01 in microfiche. USGS Water-Data Report NY-83-1, 1984. 240 p, 5 fig, 1 tab. Prepared in cooperation with the State of New York and with other agencies.

Descriptors: *New York, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Streamflow, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water analyses, Water temperature, Water levels, Water wells, *Data collections, Sites.

Water-resources data for the 1983 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 96 gaging stations; stage only at 5 gaging stations; and stage and contents at 4 gaging stations, and 19 other lakes and levels at 24 observation wells. Locations of these sites are shown on figures 4A and 4B. Also included are data for 52 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data, together with the data in Volumes 2 and 3, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W86-03186

WATER RESOURCES DATA, ARKANSAS WATER YEAR 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, J. E. Porter, B. F. Lambert, and J. Edds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-168722/AS, Price codes: A24 in paper copy, A01 in microfiche. USGS Water-Data Report AR-83-1, 1984. 561 p, 5 fig, 3 tab. Prepared in cooperation with the State of Arkansas and with other agencies.

Descriptors: *Arkansas, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Arkansas consist of records of gage height, discharge, and water quality of streams; elevation, contents, and water quality of lakes; water levels and water quality of observation wells. This report contains discharge records for 53 gaging stations; water quality for 148 stations, 49 partial-record stations, 25 observation wells; and water levels for 97 observation wells. Also included are data for 100 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (USGS)
W86-03187

WATER RESOURCES DATA, OREGON, WATER YEAR 1983, VOLUME 2: WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
L. L. Hubbard, T. D. Parks, D. L. Weiss, and L. E. Hubbard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-168714/AS, Price codes: A18 in paper copy, A01 in microfiche. USGS Water-Data Report OR-83-2, 1984. 412 p, 4 fig, 1 tab. Prepared in cooperation with the State of Oregon and with other agencies.

Descriptors: *Oregon, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Oregon consist of records of stage, discharge, annd water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report, in two volumes, contains discharge records for 254 gaging stations; stage only records for 6 gaging stations; stage and contents for 27 lakes and reservoirs; water quality for 81 stations, water levels for 56 observation wells; and water quality for 1 precipitation station. Also included are 33 crest-stage, partial-record stations. Additionel water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oregon. (USGS)
W86-03188

WATER RESOURCES DATA, INDIANA WATER YEAR 1983,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. L. Miller, R. E. Hoggatt, and G. E. Nell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127355, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report IN-82-1, 1984. 292 p, 6 fig, 3 tab. Prepared in cooperation with the State of Indiana and with other agencies.

Descriptors: *Indiana, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Water levels, Water analyses, *Data collections, Sampling sites.

Water-resources data for the 1983 water year for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 174 gaging stations, stage and contents for 9 lakes and reservoirs, releases from 7 flood control reservoirs, water quality for 5 gaging stations, and water levels for 84 observation wells. Also included are 23 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey

and cooperating State and Federal agencies in Indiana. (USGS)
W86-03189

WATER RESOURCES DATA, NEW HAMPSHIRE AND VERMONT WATER YEAR 1983,
Geological Survey, Boston, MA. Water Resources Div.
F. E. Blackey, J. E. Cotton, and K. W. Toppin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-210938, Price codes: A07 in paper copy, A01 in microfiche. USGS Water-Data Report NH-VT-83-1, 1984. 145 p, 3 fig, 1 tab. Prepared in cooperation with the States of New Hampshire and Vermont and with other agencies.

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 78 gaging stations, stage records for 4 lakes, monthend contents for 25 lakes and reservoirs, water-quality data for 3 gaging stations, and water levels for 30 observation wells. Also included are data for 4 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Locations of gaging stations, partial-record stations (not included above) in bordering States and Province of Quebec are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and by the cooperating State and Federal agencies in New Hampshire and Vermont. (USGS)
W86-03190

WATER RESOURCES DATA, SOUTH CAROLINA WATER YEAR 1983,
Geological Survey, Columbia, SC. Water Resources Div.
C. S. Bennett, R. D. Hayes, J. W. Gissendanner, and H. E. Herlong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-210573, Price codes: A15 in paper copy, A01 in microfiche. USGS Water-Data Report SC-83-1, 1984. 342 p, 5 fig. Prepared in cooperation with the State of South Carolina and with other agencies.

Descriptors: *South Carolina, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 77 gaging stations, stage only at 5 gaging stations, stage and contents at 11 lakes and reservoirs, water quality at 39 gaging stations, and water levels at 67 observation wells. Also included are data for 40 crest-stage partial-record stations. Locations of these sites are shown on figures 3, 4, and 5. Additional water data were collected at various sites not invloved in the systematic data-collection program. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and federal agencies in South Carolina. (USGS)
W86-03191

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 4. NORTHERN CALIFORNIA VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE,
Geological Survey, Sacramento, CA. Water Resources Div.
R. P. Fogelman, J. R. Mullen, W. F. Shelton, and R. G. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-225127, Price codes: A14 in paper copy, A01 in microfiche. USGS Water-Data Report CA-82-4, 1984. 319 p, 12 fig. Prepared in cooperation with the California Department of Water Resources and with other agencies.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for California consist of records of stage, discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water quality in wells. Volume 4 contains discharge records for 163 gaging stations; stage and contents for 27 lakes and reservoirs; precipitation data for 2 stations; water quality for 7 stations; and water levels for 54 observation wells. Also included are 4 crest-stage partial-record stations and 4 low-flow partial-record stations. Additional water data are collected at various sites, not part of the systematic data collection program, and are published as special investigations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-03192

WATER RESOURCES DATA, CALIFORNIA, WATER YEAR 1982, VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
R. P. Fogleman, T. C. Hunter, J. R. Mullen, and R. G. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-223726, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report CA-82-3, 1984, 379 p, 12 fig. Prepared in cooperation with the California Department of Water Resources and with other agencies.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for California consist of records of stage, discharge, gage-height, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. Volume 3 contains discharge records for 157 gaging stations; stage and contents for 39 lakes and reservoirs; gage height records for two lakes; water quality for 11 stations; and water levels for 54 observation wells. Also included are 11 crest-stage partial-record stations and one water-quality partial-record station. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-03193

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY,
Geological Survey, Sacramento, CA. Water Resources Div.
K. L. Markham, V. Piro, W. F. Shelton, and M. W. Weston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-224708, Price codes: A18 in paper copy, A01 in microfiche. USGS Water-Data Report CA-82-2, 1984, 407 p, 3 fig. Prepared in cooperation with California Department of Water Resources and with other agencies.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for California consist of records of stage, discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water quality in wells. Volume 2 contains discharge records for 153 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 19 stations; water levels for 73 observation wells. Also included are 1 low-flow partial-record station and 13 water-quality partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-03194

WATER RESOURCES DATA, CALIFORNIA WATER YEAR 1982, VOLUME 1. SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER,
Geological Survey, Sacramento, CA. Water Resources Div.
J. C. Bowers, M. T. Butcher, C. E. Lamb, J. A. Singer, and G. B. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-220870, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report CA-82-1, 1984. 363 p, 6 fig. Prepared in cooperation with the California Department of Water Resources and with other agencies.

Descriptors: *California, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for California consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality in wells. Volume 1 contains discharge records for 160 gaging stations; stage and contents for 19 lakes and reservoirs; water quality for 20 streams and 20 wells; water levels for 174 observation wells. Also included are 10 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W86-03195

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 2: ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
K. K. Fitzgerald, P. D. Hayes, T. E. Richards, and R. L. Stahl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-127363, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report IL-83-2, 1984. 385 p, 4 fig. Prepared in cooperation with the State of Illinois and with other agencies.

Descriptors: *Illinois, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels of groundwater wells. This volume contains records for water discharge at 75 gaging stations; stage only at 2 gaging stations; stage only at 3 lake stations, water quality at 95 gaging stations; and water levels at 3 observation wells. Also included are data for 15 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W86-03196

WATER RESOURCES DATA, ILLINOIS WATER YEAR 1983, VOLUME 1: ILLINOIS EXCEPT ILLINOIS RIVER BASIN,
Geological Survey, Urbana, IL. Water Resources Div.
R. L. Stahl, K. K. Fitzgerald, T. E. Richards, and P. D. Hayes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-125755, Price codes: A20 in paper copy, A01 in microfiche. USGS Water-Data Report IL-83-1, 1984, 452 p, 4 fig. Prepared in cooperation with the State of Illinois and with other agencies.

Descriptors: *Illinois, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collection.

Water-resources data for the 1983 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels of groundwater wells. This volume contains records for water discharge at 76 gaging stations; stage at 15 gaging stations; stage and contents at 3 lakes and reservoirs; and water quality at 115 gaging stations. Also included are data for 13 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W86-03197

WATER RESOURCES DATA, NORTH DAKOTA WATER YEAR 1983,
Geological Survey, Bismarck, ND. Water Resources Div.
R. E. Harkness, and N. D. Haffield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-236305, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report ND-83-1, 1984, 382 p, 18 fig, 2 tab. Prepared in cooperation with the State of North Dakota and with other agencies.

Descriptors: *North Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for North Dakota consist of records of stage, discharge, and water quality of streams; contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 112 gaging stations; stage only records for 17 gaging stations; stage and contents for 10 lakes and reservoirs; water quality for 109 gaging stations; 5 lakes, 29 wells, and water levels for 31 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in North Dakota. (USGS)
W86-03198

WATER RESOURCES DATA, NEVADA WATER YEAR 1983,
Geological Survey, Carson City, NV. Water Resources Div.
H. R. Frisbie, R. J. LaCamera, M. M. Riek, and D. B. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-210953, Price codes: A15 in paper copy, A01 in microfiche. USGS Water-Data Report NV-83-1, 1984, 328 p, 6 fig. Prepared in cooperation with several Federal, State, and local agencies.

Descriptors: *Nevada, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling siites, Water levels, Water analyses, *Data collections.

Water-resources data published herein for the 1983 water year comprise the following records: water discharge for 109 gaging stations on streams, canals, and drains; discharge data for 35 peak-flow stations and 5 low-flow stations on streams; stage and contents for 21 lakes and reservoirs; water levels for 316 observation wells; water-quality data for 85 stream, canal, and drain sites, 12 lake and reservoir sites, and 3 wells. Additional water data, collected at various sites that are not part of the systematic data-collection program, are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nevada. (USGS)
W86-03199

WATER RESOURCES DATA, OREGON WATER YEAR 1983, VOLUME 1: EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
L. L. Hubbard, T. D. Parks, and D. L. Weiss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-168706, Price codes: A10 in paper copy, A01 in microfiche. USGS Water-Data Report OR-83-1, 1984. 202 p, 4 fig, 1 tab. Prepared in cooperation with the State of Oregon and with other agencies.

Descriptors: *Oregon, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Oregon consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report, in two volumes, contains discharge records for 254 gaging stations; stage only records for 6 gaging stations; stage and contents for 27 lakes and reservoirs; and water levels and water quality in wells and springs. This report, in two volumes, contains discharge records for 254 gaging stations; stage only records for 6 gaging stations; stage and contents for 27 lakes and reservoirs; water quality for 81 stations, water levels for 56 observation wells; and water quality for 1 precipitation station. Also included are 33 crest-stage, partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oregon. (USGS)
W86-03200

WATER RESOURCES DATA, UTAH WATER YEAR 1983,
Geological Survey, Salt Lake City, UT. Water Resources Div.
M. D. ReMillard, G. A. Birdwell, R. B. Garrett, and G. W. Sandberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128387, Price codes: A21 in paper copy, A01 in microfiche. USGS Water-Data Report UT-83-1, 1984, 489 p, 13 fig, 4 tab. Prepared in cooperation with the State of Utah and with other agencies.

Descriptors: *Utah, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 228 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 48 hydrologic stations and 106 wells; miscellaneous temperature measurements and field determinations for 155 stations; and water levels for 36 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (USGS)
W86-03201

WATER RESOURCES DATA, FLORIDA WATER YEAR 1981, VOLUME 4, NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-162569, Price codes: A99 in paper copy, A01 in microfiche. USGS Water-Data Report FL-81-4, 1981, 652 p, 46 fig, 1 tab. Prepared in cooperation with the State of Florida and with other agencies.

Descriptors: *Florida, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Elevations, Water wells, *Data collections.

Water-resources data for the 1981 water year in Florida consist of continuous or daily discharge for 279 streams, periodic discharge for 52 streams, continuous or daily stage for 64 streams, periodic stage for 82 streams, peak discharge for 78 streams and peak stage for 55 streams; continuous or daily elevations for 77 lakes, periodic elevations for 144 lakes; continuous groundwater levels for 488 wells, periodic ground-water levels for 575 wells, and miscellaneous water-level measurements for 2,317 wells; quality of water data for 444 surface-water sites and 613 wells. The data for northwest Florida include continuous or daily discharge for 64 streams, periodic discharge for 19 streams, peak discharge for 41 streams, and continuous or daily stage for 8 streams; continuous elevations for 4 lakes and periodic elevations for 26 lakes; continuous ground-water levels for 38 wells, periodic ground-water levels for 154 wells, and miscellaneous water-level measurements for 264 wells; quality of water for 36 surface-water sites and for 113 wells. (USGS)
W86-03202

WATER RESOURCES DATA, WEST VIRGINIA WATER YEAR 1981, APPENDIX - COAL AREAS AND SPECIAL PROJECTS,
Geological Survey, Charleston, WV. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-124726, Price codes: A09 in paper copy, A01 in microfiche.

USGS Water-Data Report WV-81-4, 1982. 192 p, 11 fig, 12 tab. Prepared in cooperation with the State of West Virginia and with other agencies.

Descriptors: *West Virginia, Hydrologic data, Surface water, Ground water, Water quality, Flow rate, Chemical analyses, Sediments, Water temperature, Water levels, Water analyses, Sampling sites, *Data collections.

The first section of this report contains data collected during the 1981 water year for the West Virginia Coal Hydrology monitoring project. Records consist of discharge and water-quality data collected at 246 sites in July, at 29 sites in August, and sediment data for 235 sites collected in July. The second section of this report contains data collected during the period January 1978 to December 1981 for the water resources study of the Tug Fork and Twelvepole Creek basins. Records consist of physical data for 347 wells, water level data for two wells, quality analyses of water from 328 wells, and discharge, chemical and biological data for 91 sites sampled several times. (USGS)
W86-03203

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1982,
Geological Survey, Towson, MD. Water Resources Div.
R. W. James, R. H. Simmons, and B. F. Strain.
USGS Water-Data Report MD-DE-82-1, 1983. 382 p, 4 fig, 1 tab. Prepared in cooperation with the States of Maryland and Delaware and with other agencies.

Descriptors: *Maryland, *Delaware, *District of Columbia, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 108 gaging stations; stage and contents at 1 reservoir; water quality at 43 gaging stations and 129 wells; and water levels at 27 observation wells. Also included are data for 12 crest-stage, 59 low-flow, and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
W86-03204

WATER RESOURCES DATA, MAINE WATER YEAR 1982,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Morrill, C. R. Haskell, G. C. Prescott, and T. J. Maloney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227348, Price codes: A08 in paper copy, A01 in microfiche. USGS Water-Data Report ME-82-1, 1983. 172 p, 3 fig, 1 tab. Prepared in cooperation with the State of Maine and with other agencies.

Descriptors: *Maine, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Maine consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 70 gaging stations; stage only for 1 gaging station; contents for 17 lakes and reservoirs; water quality for 19 gaging stations; and water levels for 32 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03205

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3B: SOUTHWEST FLORIDA GROUND WATER,
Geological Survey, Tampa, FL. Water Resources Div.
R. T. Mycyk, L. D. Fayard, W. L. Fletcher, and J. K. Ogle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-220862, Price codes: A20 in paper copy, A01 in microfiche. USGS Water-Data Report FL-82-3B, 1983. 468 p, 19 fig, 1 tab. Prepared in cooperation with the State of Florida and with other agencies.

Descriptors: *Florida, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Elevations, Water wells, *Data collections.

Water-resources data for the 1982 water year in Florida consist of continuous or daily discharge for 264 streams, periodic discharge for 41 streams, miscellaneous discharge for 71 streams, continuous or daily stage for 102 streams, periodic stage for 15 streams, peak discharge for 83 streams and peak stage for 8 streams; continuous or daily elevations for 102 lakes, periodic elevations for 111 lakes; continuous ground-water levels for 420 wells, periodic ground-water levels for 587 wells, and miscellaneous water-level measurements for 2,794 wells; quality-of-water data for 327 surface-water sites and 791 wells. The data for southwest Florida include continuous or daily discharge for 72 streams, periodic discharge for 28 streams, miscellaneous discharge for 19 streams, peak discharge for 10 streams, continuous or daily stage for 15 streams and periodic stage for 7 streams; continuous elevations for 42 lakes and periodic elevations for 68 lakes; continuous ground-water levels for 229 wells, periodic ground-water levels for 238 wells, and miscellaneous water-level measurements for 1,211 wells; quality of water for 132 surface-water sites and for 228 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W86-03206

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1A: NORTHEAST FLORIDA SURFACE WATER,
Geological Survey, Orlando, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-162338, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report FL-82-1A, 1983. 287 p, 18 fig, 1 tab. Prepared in cooperation with the State of Florida and with other agencies.

Descriptors: *Florida, *Hydrologic data, *Surface water, *Ground water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Elevations, Water wells, *Data collections.

Water-resources data for the 1982 water year in Florida consists of continuous or daily discharge for 264 streams, periodic discharge for 41 streams, miscellaneous discharge for 71 streams, continuous or daily stage for 102 streams, periodic stage for 15 streams, peak discharge for 83 streams and peak stage for 8 streams; continuous or daily elevations for 102 lakes, periodic elevations for 111 lakes; continuous ground water levels for 420 wells, periodic ground water levels for 587 wells, and miscellaneous water level measurements for 2,794 wells; quality of water data for 327 surface water sites and 791 wells. The data for northeast Florida includes continuous or daily discharge for 61 streams, periodic discharge for 8 streams, miscellaneous discharge for 21 streams, peak discharge for 29 streams, low-flow discharge for 2 streams, continuous or daily stage for 73 streams; continuous elevations for 40 lakes and periodic elevations for 15 lakes; continuous ground water levels for 32 wells, periodic ground water levels for 91 wells, and miscellaneous water level measurements for 779 wells; quality of water for 23 surface water sites and for 173 wells. (USGS)
W86-03207

WATER RESOURCES DATA, TEXAS, WATER YEAR 1982, VOLUME 3; COLORADO RIVER, LAVACA RIVER, GUADALUPE RIVER, NUECES RIVER, RIO GRANDE BASINS AND INTERVENING COASTAL BASINS,
Geological Survey, Austin, TX. Water Resources Div.
B. C. Massey, H. D. Buckner, E. R. Carrillo, and H. J. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-131820, Price codes: A21 in paper copy, A01 in microfiche. USGS Water-Data Report TX-82-3, 1983. 491 p, 1 fig, 1 tab. Prepared in cooperation with the State of Texas and with other agencies.

Descriptors: *Texas, *Hydrologic data, *Surface water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water analyses, *Data collections.

Surface-water data for the 1982 water year for Texas are presented in three volumes, appropriately identified as to content by river basins. Data in each volume consist of records of stage, discharge, and water quality of streams and canals; and stage, contents, and water quality of lakes and reservoirs. Also included are crest-stage and flood-hydrograph partial-record stations, reconnaissance partial-record stations, and low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. (USGS)
W86-03208

WATER RESOURCES DATA, MISSOURI WATER YEAR 1983,
Geological Survey, Rolla, MO. Water Resources Div.
L. A. Waite, D. O. Hatten, and P. W. Cross.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-168730/AS, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report MO-83-1, 1984. 292 p, 5 fig, 3 tab. Prepared in cooperation with the State of Missouri and with other agencies.

Descriptors: *Missouri, *Hydrologic data, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water analysis, Water levels, *Data collections, Sites.

Water-resources data for the 1983 water year for Missouri consist of records of stage, discharge, and water quality of lakes and reservoirs; contains records for water discharge at 110 gaging stations; stage and contents at 9 lakes and reservoirs; water quality at 24 gaging stations (including 1 lake) and data for 35 crest-stage, and 30 water-quality partial-record stations. (USGS)
W86-03209

WATER RESOURCES DATA, WYOMING WATER YEAR 1983,
Geological Survey, Cheyenne, WY. Water Resources Div.
S. A. Druse, J. R. Schuetz, and S. J. Rucker.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB85-127371, Price codes: A22 in paper copy, A01 in microfiche. USGS Water-Data Report WY-83-1, 1984. 508 p, 6 fig, 2 tab. Prepared in cooperation with the State of Wyoming and with other agencies.

Descriptors: *Wyoming, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Wyoming consist of records of stage, discharge and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 193 gaging stations; stage and contents for 14 lakes and reservoirs; water quality for 83 gaging stations, and 63 ungaged stations; and water levels for 35 observation wells. Also included are 32 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (USGS)
W86-03210

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 3A: SOUTHWEST FLORIDA SURFACE WATER,
Geological Survey, Tampa, FL. Water Resources Div.
R. T. Mycyk, L. D Fayard, W. L. Fletcher, and J. K. Ogle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-223080, Price codes: A25 in paper copy, A01 in microfiche. USGS Water-Data Report FL-82-3A, 1983. 616 p, 15 fig, 1 tab. Prepared in cooperation with the State of Florida and with other agencies.

Descriptors: *Florida, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Elevations, Water wells, *Data collections.

Water-resources data for the 1982 water year in Florida consist of continuous or daily discharge for 264 streams, periodic discharge for 41 streams, miscellaneous discharge for 71 streams, continuous or daily stage for 102 streams, periodic stage for 15 streams, peak discharge for 83 streams and peak stage for 8 streams; continuous or daily elevations for 102 lakes, periodic elevations for 111 lakes; continuous ground-water levels for 420 wells, periodic ground-water levels for 587 wells, and miscellaneous water-level measurements for 2,794 wells; quality-of-water data for 327 surface-water sites and 791 wells. The data for southwest Florida include continuous or daily discharge for 72 streams, periodic discharge for 28 streams, miscellaneous discharge for 19 streams, peak discharge for 10 streams, continuous or daily stage for 15 streams and periodic stage for 7 streams; continuous elevations for 42 lakes and periodic elevations for 68 lakes; continuous ground-water levels for 229 wells, periodic ground-water levels for 238 wells, and miscellaneous water-level measurements for 1,211 wells; quality of water for 132 surface-water sites and for 228 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State, and Federal agencies in Florida. (USGS)
W86-03211

WATER RESOURCES DATA, FLORIDA WATER YEAR 1982, VOLUME 1B: NORTHEAST FLORIDA GROUND WATER,
Geological Survey, Orlando, FL. Water Resources Div.
L. D. Fayard, D. M. Bonnet, and R. G. Belles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-161876, Price codes: A10 in paper copy, A01 in microfiche. USGS Water-Data Report FL-82-1B, 1983. 221 p, 24 fig, 1 tab. Prepared in cooperation with the State of Florida and with other agencies.

Descriptors: *Florida, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, Elevations, Water wells, *Data collections.

Water-resources data for the 1982 water year in Florida consist of continuous or daily discharge for 264 streams, periodic discharge for 41 streams, miscellaneous discharge for 71 streams, continuous or daily stage for 102 streams, periodic stage for 15 streams, peak discharge for 83 streams and peak stage for 8 streams; continuous or daily elevations for 102 lakes, periodic elevations for 111 lakes; continuous ground-water levels for 420 wells, periodic ground-water levels for 587 wells, and miscellaneous water level measurements for 2,794 wells; quality of water data for 327 surface water sites and 791 wells. The data for northeast Florida includes continuous or daily discharge for 61 streams, periodic discharge for 8 streams, miscellaneous discharge for 21 streams, peak discharge for 29 streams, low-flow discharge for 2 streams, continuous or daily stage for 73 streams; continuous elevations for 40 lakes and periodic elevations for 15 lakes; continuous ground-water levels for 32 wells, periodic ground-water levels for 91 wells, and miscellaneous water level measurements for 779 wells; quality of water for 23 surface water sites and for 173 wells. (USGS)
W86-03212

WATER RESOURCES DATA, VIRGINIA WATER YEAR 1983,
Geological Survey, Richmond, VA. Water Resources Div.
B. J. Prugh, F. J. Easton, and D. D. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-2244542, Price codes: A19 in paper copy, A01 in microfiche. USGS Water-Data Report VA-83-1, 1984. 442 p, 6 fig, 4 tab.

Descriptors: *Virginia, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collection.

Water-resources data for the 1983 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 196 gaging stations; stage only at 1 gaging station; stage and contents at 10 lakes and reservoirs; water quality at 47 gaging stations and 2 wells; and water levels at 60 observation wells. Also included are data for 77 crest-stage partial-record stations. Locations of these sites are shown on Figures 5 and 6. Additional water data were collected at various sites not involved in the systematic data-collection program. Discharge measurements were made at 220 low-flow partial-record stations. Miscellaneous data were collected at 215 measuring sites and 51 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (USGS)
W86-03213

WATER RESOURCES DATA, MAINE WATER YEAR 1983,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Morrill, C. R. Haskell, J. T. Adamik, and W. B. Higgins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-225143, Price codes: A08 in paper copy, A01 in microfiche. USGS Water-Data Report ME-83-1, 1984. 152 p, 3 fig, 1 tab. Prepared in cooperation with the State of Maine and with other agencies.

Descriptors: *Maine, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collection.

Water-resources data for the 1983 water year for Maine consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 56 gaging stations; stage only for 2 gaging stations; contents for 17 lakes and reservoirs; water quality for 11 gaging stations; and water levels for 32 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03214

WATER RESOURCES DATA, WISCONSIN WATER YEAR 1983,
Geological Survey, Madison, WI. Water Resources Div.
B. K. Holmstrom, C. A. Harr, and R. M. Erickson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128379, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report WI-83-1, 1984. 352 p, 5 fig. Prepared in cooperation with the State of Wisconsin and with other agencies.

Descriptors: *Wisconsin, *Hydrologic data, *Surface water, *Groundwater, *Water quality, *Acid deposition, Flow rate, Gaging stations, Lakes, Chemical analyses, Microbiological analyses, Sediment, Water levels, *Data collections.

Water-resources data for the 1983 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of chemical, biological, and physical characteristics of surface and ground water. Records of chemical analysis of precipitation, surface and ground water associated with acid deposition are included. In addition water levels in observation wells are reported. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and local agencies and for other Federal agencies in Wisconsin. (USGS)
W86-03215

WATER RESOURCES DATA, WEST VIRGINIA WATER YEAR 1983,
Geological Survey, Charleston, WV. Water Resources Div.
W. N. Embree, E. A. Friel, F. M. Taylor, and T. A. Ehlke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128023, Price codes: A11 in paper copy, A01 in microfiche. USGS Water-Data Report WV-83-1, 1984. 234 p, 5 fig. Prepared in cooperation with the State of West Virginia and with other agencies.

Descriptors: *West Virginia, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs, and water levels in wells. This report contains discharge records for 83 gaging stations; stage only records for 15 gaging stations; water quality for 27 gaging stations; and water levels for 31 observation wells. Also included are 2 crest-stage partial-record stations, and 1 low-flow partial record station. Additional water data were collected at various sites, not part of the systematic data-collections

program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)
W86-03216

WATER RESOURCES DATA, OKLAHOMA WATER YEAR 1982,
Geological Survey, Oklahoma City, OK. Water Resources Div.
L. D. Hauth, J. K. Kurklin, D. M. Walters, and D. M. Ferree.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-166668/AS, Price codes: A15 in paper copy, A01 in microfiche. USGS Water-Data Report OK-82-1, 1983. 336 p, 6 fig. Prepared in cooperation with the State of Oklahoma and with other agencies.

Descriptors: *Oklahoma, *Hydrologic data, *Surface water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Oklahoma consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes or reservoirs. This report contains discharge records for 125 gaging stations; stage and contents for 26 lakes or reservoirs; water quality for 38 gaging stations and 3 lakes. Also included are 39 crest-stage partial-record stations and 3 low-flow stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (USGS)
W86-03217

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1982,
Geological Survey, Lincoln, NE. Water Resources Div.
G. B. Engel, R. A. Engberg, and M. S. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-223668, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report NE-82-1, 1984. 369 p, 5 fig, 3 tab. Prepared in cooperation with the State of Nebraska and with other agencies.

Descriptors: *Nebraska, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Nebraska consist of both surface water and ground water. This report contains water-discharge records for 157 streamflow gaging stations, 27 partial-record or miscellaneous streamflow stations, and 5 crest-stage, partial-record streamflow stations; stage and content records for 10 lakes and reservoirs; water-quality records for 47 streamflow stations, 29 ungaged streamsites, and 57 wells; and water-level records for 59 observation wells. Additional water-discharge data were collected at various sites, not part of the systematic data-collection program, to determine surface-water/groundwater relationships and are published under low-flow investigations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nebraska. (USGS)
W86-03218

WATER RESOURCES DATA, MICHIGAN WATER YEAR 1983,
Geological Survey, Lansing, MI. Water Resources Div.
J. B. Miller, J. L. Oberg, and T. Sieger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-225176, Price codes: A13 in paper copy, A01 in microfiche. USGS Water-Data Report MI-83-1, 1984. 289 p, 9 fig. Prepared in cooperation with the State of Michigan and with other agencies.

Descriptors: *Michigan, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collection.

Water-resources data for the 1983 water year for Michigan consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 143 gaging stations; stage only records for 3 gaging stations; stage and contents for 5 lakes and reservoirs; water quality for 33 continuous-record stations; and water levels for 53 observation wells. Also included are 74 crest-stage partial-record stations and 8 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Michigan. (USGS)
W86-03219

WATER RESOURCES DATA, ALABAMA WATER YEAR 1983,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
H. C. Rollins, F. C. Sedberry, E. G. Ming, and J. W. Tucker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-123842, Price codes: A20 in paper copy, A01 in microfiche. USGS Water-Data Report AL-83-1, 1984. 458 p, 7 fig, 1 tab. Prepared in cooperation with the Alabama Department of Environmental Management, Geological Survey of Alabama, the Alabama Highway Department, and with other State, municipal, and Federal agen

Descriptors: *Alabama, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 86 gaging stations; stage only for 18 gaging stations, stage and contents for 13 lakes and reservoirs; water quality for 78 gaging stations, 47 wells, 2 precipitation stations, and water levels for 53 observation wells. Also included are 5 crest-stage partial-record stations, 6 flood hydrograph partial-record stations and 55 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (USGS)
W86-03220

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
K. T. Gunard, J. H. Hess, J. L. Zirbel, and C. E. Cornelius.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-163047, Price codes: A10 in paper copy, A01 in microfiche. USGS Water-Data Report MN-82-1, 1983. 212 p, 8 fig. Prepared in cooperation with the State of Minnesota and with other agencies.

Descriptors: *Minnesota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Minnesota consist of records of stage, discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 47 gaging stations; stage-only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 15 gaging stations, 2 stage stations, 20 partial-record stations, and 5 wells; and water levels for 47 observation wells. Also included are 43 high-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. (USGS)
W86-03221

WATER RESOURCES DATA, MINNESOTA WATER YEAR 1982, VOLUME 2: UPPER MISSISSIPPI AND MISSOURI RIVER BASINS,
Geological Survey, St. Paul, MN. Water Resources Div.
K. T. Gunard, J. H. Hess, J. L. Zirbel, and C. E. Cornelius.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-163054, Price codes: A19 in paper copy, A01 in microfiche. USGS Water-Data Report MN-82-2, 1983. 449 p, 9 fig. Prepared in cooperation with the State of Minnesota and with other agencies.

Descriptors: *Minnesota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Minnesota consist of records of stage, discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 83 gaging stations; stage and contents for 9 lakes and reservoirs; water quality for 27 stream stations, 19 partial-record stations, 1 precipitation station, and 63 wells; and water levels for 238 observation wells. Also included are 108 high-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. (USGS)
W86-03222

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 1. OHIO RIVER BASIN,
Geological Survey, Columbus, OH. Water Resources Div.
H. L. Shindel, L. L. Stewart, and J. R. Kolva.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-224690, Price codes: A15 in paper copy, A01 in microfiche. USGS Water-Data Report OH-83-1, 1984. 339 p, 3 fig. Prepared in cooperation with the State of Ohio and with other agencies.

Descriptors: *Ohio, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Sampling sites, Water levels, Water analyses, Streamflow, Water wells, Benthic fauna, *Data collections, *Ohio River Basin.

Water-resources data for the 1983 water year for Ohio consist of records of stage discharge and water quality of streams; stage and contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 135 gaging stations; stage and contents at 35 lakes and reservoirs; water quality at 24 gaging stations, 117 wells and 6 synoptic sites; and water levels at 168 observation wells. Also

included are data from 70 crest-stage partial-record stations, 42 low-flow partial-record stations, and 10 miscellaneous sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (USGS)
W86-03223

WATER RESOURCES DATA, OHIO WATER YEAR 1983, VOLUME 2. ST. LAWRENCE RIVER BASIN STATEWIDE PROJECT DATA,
Geological Survey, Columbus, OH. Water Resources Div.
H. L. Shindel, L. L. Steward, and J. R. Kolva.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-223676, Price codes: A09 in paper copy, A01 in microfiche. USGS Water-Data Report OH-83-2, 1984. 182 p, 3 fig. Prepared in cooperation with the State of Ohio and with other agencies.

Descriptors: *Ohio, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Sampling sites, Water levels, Water analyses, Streamflow, Water wells, Benthic fauna, *Data collections.

Water-resources data for the 1983 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage and contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 135 gaging stations; stage and contents at 35 lakes and reservoirs; water quality at 24 gaging stations, 117 wells and 6 synoptic sites; and water levels at 168 observation wells. Also included are data from 70 crest-stage partial-record stations, 42 low-flow partial-record stations, and 10 miscellaneous sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (USGS)
W86-03224

WATER RESOURCES DATA, NEBRASKA WATER YEAR 1983,
Geological Survey, Lincoln, NE. Water Resources Div.
G. B. Engel, R. A. Engberg, and M. S. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-170371/AS, Price codes: A17 in paper copy, A01 in microfiche. USGS Water-Data Report NE-83-1, 1984. 391 p, 5 fig, 4 tab. Prepared in cooperation with the State of Nebraska and with other agencies.

Descriptors: *Nebraska, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Nebraska consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and wter quality in wells. This report contains discharge records for 159 streamflow gaging stations, 30 partial-record or miscellaneous streamflow stations, and 5 crest-stage, partial-record streamflow stations; stage and content records for 10 lakes and reservoirs; water-quality records for 46 streamflow stations, 34 ungaged streamsites, and 104 wells; and water-level records for 58 observation wells. Additional discharge and water-quality data were collected at various sites, not part of the systematic data-collection program, to determine surface-water/ground-water relationships and are published under low-flow investigations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nebraska. (USGS)
W86-03225

WATER RESOURCES DATA, MARYLAND AND DELAWARE WATER YEAR 1983,
Geological Survey, Towson, MD. Water Resources Div.
R. W. James, R. H. Simmons, and B. F. Strain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-225135, Price codes: A16 in paper copy, A01 in microfiche. USGS Water-Data Report MD-DE-83-1, 1984. 365 p, 3 fig, 1 tab. Prepared in cooperation with the States of Maryland and Delaware and with other agencies.

Descriptors: *Maryland, *Delaware, *District of Columbia, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collection.

Water-resources data for the 1983 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams, stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 98 gaging stations; stage and contents at 1 reservoir; water quality at 33 gaging stations and 325 wells; and water levels at 24 observation wells. Also included are data for 13 crest-stage and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
W86-03226

WATER RESOURCES DATA, ARIZONA WATER YEAR 1982,
Geological Survey, Tucson, AZ. Water Resources Div.
N. D. White, and W. B. Garrett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128361, Price codes: A19 in paper copy, A01 in microfiche. USGS Water-Data Report AZ-82-1, 1984. 0 p, 8 fig. Prepared in cooperation with the State of Arizona and with other agencies.

Descriptors: *Arizona, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediment, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. This report contains discharge records for 212 gaging stations, annual peaks for 16 crest-stage partial-record stations, and discharge measurements at 11 miscellaneous sites; contents only records for 8 lakes and reservoirs; stage and contents for 1 lake; elevation and discharge for 1 streamflow station; elevation only for 1 streamflow station; 16 supplementary records, included with gaging-station records, consisting of month-end or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; water-quality records for 60 continuous-record stations and 3 miscellaneous sites; water levels for 97 observation wells; and water-quality data for water from 247 wells. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal and State agencies in Arizona. (USGS)
W86-03227

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 1: HUDSON BAY AND MISSOURI RIVER BASINS,
Geological Survey, Helena, MT. Water Resources Div.
R. R. Shields, J. R. Knapton, M. K. White, M. A. Jacobson, and M. L. Kasman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128031, Price codes: A25 in paper copy, A01 in microfiche. USGS Water-Data Report MT-83-1, 1984. 585 p, 10 fig, 8 tab. Prepared in cooperation with the State of Montana and with other agencies.

Descriptors: *Montana, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses. Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. Volume 1 of this report contains discharge records for 206 gaging stations; stage only records for 1 lake station; stage/contents for 5 lakes and reservoirs; water quality for 101 stations; water levels for 6 observation wells. Also included are 141 crest-stage partial-record stations and 33 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. Specific conductance determinations are also published for each discharge measurement made during the year. (USGS)
W86-03228

WATER RESOURCES DATA, MONTANA WATER YEAR 1983, VOLUME 2, COLUMBIA RIVER BASIN,
Geological Survey, Helena, MT. Water Resources Div.
R. R. Shields, J. R. Knapton, M. K. White, M. A. Jacobson, and M. L. Kasman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB85-128411, Price codes: A09 in paper copy, A01 in microfiche. USGS Water-Data Report MT-83-2, 1984. 12 p, 7 fig, 6 tab. Prepared in cooperation with the State of Montana and with other agencies.

Descriptors: *Montana, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1983 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. Volume 2 of this report contains discharge records for 54 gaging stations; stage/contents for 3 lakes and reservoirs; water quality for 24 stations, 3 lakes; water levels for 13 observations wells. Also included are 22 crest-stage partial-record stations and 20 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (USGS)
W86-03229

QUEBEC: SURFACE WATER DATA, 1984,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 2E.
W86-03235

PROJECT SKYWATER 1983-84 SCPP DATA INVENTORY: SIERRA COOPERATIVE PILOT PROJECT,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Resources Research.
For primary bibliographic entry see Field 2B.
W86-03278

MANITOBA: SURFACE WATER DATA, 1984,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 2E.
W86-03287

8. ENGINEERING WORKS

8A. Structures

SAFETY TREATMENT OF ROADSIDE PARALLEL-DRAINAGE STRUCTURES,
Texas Transportation Inst., College Station.
H. E. Ross, T. J. Hirsch, and D. Sicking.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-172684, Price codes: A08 in paper copy, A01 in microfiche. Research Report 280-2F, June 1981. 162 p, 19 fig, 4 tab, 9 ref, 2 append.

Descriptors: *Drainage ditches, *Culverts, *Safety, *Highways, *Design criteria, Roads, Hydraulic structures, Models, Simulation analysis, Shoulder ditches, Cost-benefit analysis, Slopes, Computer models.

Research was conducted to develop traffic-safe end treatments for parallel-drainage structures that would not appreciably restrict water flow. Parallel-drainage culverts are used to convey water under driveways, side roads, or median crossovers. Preliminary designs were evaluated using a computer simulation program and a full-scale test program. From these studies, tentative design parameters were selected. The end treatment developed in the preliminary studies was then subjected to full-scale prototype testing. These tests involved evaluation of the end treatment on a 6.7 to 1 driveway slope with a subcompact automobile. The end treatment was subjected to tests at 40 and 50 miles/hr. A benefit/cost analysis was conducted to determine warrants for the use of the treatment. To achieve a traffic-safe driveway/culvert design the following conditions should be met: the roadway sideslope and driveway slope should be 6 to 1 or flatter; the transition area between the roadway sideslope and the driveway slope should be rounded or smoothed as opposed to an abrupt transition; safety treatment of the culvert opening should include an end section cut to match the driveway slope with grates spaced about every 2 ft perpendicular to the direction of water flow and strong enough to support a load of about 10,000 pounds. Based on the benefit/cost analysis, guidelines were developed that identify conditions that warrant safety treatment of parallel drainage culverts on rural high-speed highways. (Geiger-PTT)
W86-03250

REHABILITATION OF A CALCIUM CARBONATE CLOGGED DRAINAGE SYSTEM USING SULFAMIC ACID,
Bureau of Reclamation, Billings, MT. Upper Missouri Region.
For primary bibliographic entry see Field 4B.
W86-03268

IN SITU SEISMIC INVESTIGATION OF COYOTE DAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.
R. E. Wahl, J. L. Llopis, and R. F. Ballard.
Miscellaneous Paper GL-81-1, March 1981. Final Report. 48 p, 28 fig.

Descriptors: *Seismic investigation, *Seismic waves, Compression waves, Shear waves, Velocity, On-site investigations, Coyote Dam, California.

An in situ seismic investigation consisting of surface refraction seismic, downhole, and crosshole tests was conducted at Coyote Dam, near Ukiah, California. Compression- and shear-wave (P- and S-wave) velocities as a function of depth were determined at two cross sections of the dam (sta 118+00 and 126+00). P- and S-wave velocity profiles were also determined for the materials which comprise the left abutment. The profiles constructed for the dam showed that P-wave velocities in the core increased from 2100 to 4000 fps with depth. The random fill section of the dam was determined to have a velocity of 3600 fps. A horizontal gravel blanket drain underlying the random section was determined to have a velocity of 4800 fps. The P-wave velocity of the dam's foundation materials had velocities ranging between 4100 and 7600 fps. The S-wave velocity profiles showed that velocities ranging between 41 and 7600 fps. The S-wave velocity profiles showed that velocities in the dam's core increased from 850 to 1250 fps except at sta 126+00 where a velocity of 950 fps was noted for the lower 50 ft of core material. The random fill section of the dam had a velocity of 1400 fps, with its underlying horizontal gravel drain having a velocity of 1600 fps. The materials on the left abutment displayed P-wave velocities ranging between 1600 and 5500 fps. The S-wave velocities for these materials ranged betwen 850 and 1950 fps.
W86-03296

PAWCATUCK RIVER AND NARRAGANSETT BAY DRAINAGE BASINS WATER AND RELATED LAND RESOURCES STUDY: BLACKSTONE RIVER WATERSHED,
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-120073, Price codes: A05 in paper copy, A01 in microfiche. Main Report, August 1981. 92 p, 3 fig, 8 tab, 5 plates + Environmental Assessment.

Descriptors: *Flood control, *Flood protection, Flood damage, Pawtucket River Basin, Narragansett Bay, Environmental impact statement, Planning, Financing, Economic evaluation, Cost sharing, Massachusetts.

The Blackstone River Watershed Study, a component of the overall Pawtucket River and Narragansett Bay Drainage Basins (PNB) Study, reviewed some 40 potential projects to meet the flood control and other water resource needs in the study area. This report describes the area under study and its problems, needs and opportunities with regard to flooding. The investigation determined that local flood protection plans for the Berkeley Industrial Park in Cumberland, Rhode Island were the only plans to produce net economic and environemtnal benefits. Although the town of Cumberland supported the $6.1 million structural solution for Berkeley involving 5,100 feet of dike and walls, the non-Federal costs under the proposed cost sharing policies was beyond the financial resources of the town. The town therefore requested the Army Corps of Engineers to pursue the $1.2 million non-structural solution involving 1,290 feet of ringwalls and flood proofing for three buildings and the town pumping station. The report also contains the Environmental Assessment of the Berkeley Local Protection Project.
W86-03301

DISSOLVED NITROGEN MEASUREMENTS AT CLARKS HILL RESERVOIR GEORGIA-SOUTH CAROLINA,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
D. H. Merritt, and D. Leggett.
Miscellaneous Paper E-81-3, U.S. Army Environmental and Water Quality Operational Studies, September 1981. Final Report. 20 p, 4 fig, 9 plates, 7 ref.

Descriptors: *Dissolved oxygen, *Nitrogen, *Reservoirs, *Oygenation, *Dissolved nitrogen, *Reservoir operation, *Aeration, *Denitrification, Water quality, On-site investigations, *Gas chromatography, Oxygen depletion, Sediments, Water quality management, Water analysis, Georgia, South Carolina.

Several oxygen injection systems have been investigated to enhance the dissolved oxygen distribution in the withdrawal zone of a reservoir, thereby increasing the dissolved oxygen concentration in the downstream area. Additionally, oxygen injection could result in nitrogen stripping in the water column as a result of the induced changes in the relative partial pressures. A short-term field study was conducted to investigate the effect of oxygen injection on dissolved nitrogen concentrations. An innovative portable gas chromatograph system was used to measure dissolved nitrogen and the results were compared with data obtained from simpler, but less accurate systems. In the immediate vicinity of the oxygen-injection site, the nitrogen released far overshadowed the nitrogen stripped and a net increase was observed. The maximum nitrogen concentration observed in the reservoir was 111 percent of surface saturation. The increase in nitrogen concentration was apparently due to denitrification of entrained anoxic sediments. (Author)
W86-03304

BUFFALO METROPOLITAN AREA, NEW YORK WATER RESOURCES MANAGEMENT: INTERIM REPORT ON FEASIBILITY OF FLOOD MANAGEMENT IN TONAWANDA CREEK WATERSHED,
Corps of Engineers, Buffalo, NY. Buffalo District.
Final Feasibility Report, Main Report, November 1981. 125 p, 11 tab, 22 photos, 15 plates, 2 app, addendum.

Descriptors: *Flood control, *Reservoir capacity, *Tonawanda Creek, Batavia, *New York, Dams, Earth dams, Spillways, Flood protection.

This report recommends construction of the Batavia Reservoir Compound modified alternative to provide flood damage reduction in the Tonawanda Creek Watershed, New York. The alternative consists of two shallow detention reservoirs (normally dry) arranged in series. The reservoirs would be formed by construction of two earth dams. Each dam would have principal outlet works comprised of side-by-side conduits; five for the upper dam and four for the lower, with dimensions of 11 ft. by 11 ft. Each conduit would be equipped with an electrically operable gate and provisions for manual operation. The spillways of both dams would be riprapped on the upstream and downstream and crests. The amount of reservoir flood control storage and operation of the selected plan were developed to meet the planning objectives of the study. The degree of protection afforded by the plan is approximately 500-years in the city of Batavia and variable downstream.
W86-03305

SUMMARY REPORT: MODEL-PROTOTYPE COMPARISON STUDY OF DIKE SYSTEMS, MISSISSIPPI RIVER; POTAMOLOGY INVESTIGATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
J. J. Franco.
Technical Report HL-82-11, May 1982. Final Report. 85 p, 30 plates.

Descriptors: *Model studies, *Comparison studies, *Dikes, *Spur dikes, *Channel improvement, *Stream stabilization, *Mississippi River, *Prototype tests, Levees, Models, Stream improvement, Unstable channels, Hydrologic models, Rivers, Performance evaluation, Prototypes, Hydraulic models.

In conjunction with the Mississippi River Commission Potamology Program, movable-bed model studies were conducted of seven of the most complex and troublesome reaches of the Mississippi River to assess the effectiveness of plans proposed for the improvement and stabilization of those reaches. Due to the limited size and shape of the test facility, only a relatively short reach of the river including the problem could be reproduced in each model with little or no overbank areas. Model results showed that qualitative predictions could be made of most of the principal trends in the river using the plans tested. The degree of

accuracy of the models varied and depended on the model adjustment, characteristics of the reach, flow conditions, and similarity between plans tested and actual construction. Analyses of model and prototype data allowed an evaluation to be made of the performance of various types of dikes and dike systems and some of the principles involved in the developments within alluvial streams.
W86-03307

ASSESSMENT OF IMPLANTED SUBSTRATE SAMPLERS FOR MACROINVERTEBRATES INHABITING STONE DIKES OF THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5C.
W86-03309

SACO RIVER-CAMP ELLIS HARBOR, SACO, MAINE: SMALL NAVIGATION PROJECT, DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT,
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA120063, Price codes: A09 in paper copy, A01 in microfiche. December 1981, 200 p, 13 fig, 5 tab, 5 app, 17 ref.

Descriptors: *Dredging, *Harbors, *Ice breakup, Commercial fishing, Benthic environment, Sediments, Navigation, Cost-benefit analysis, Piers, Economic justification, Government finance, Saco River, Maine.

The paramount navigation need identified at Saco, Maine, is the protection of the harbor from ice flows in the Saco River, to give year-round use of the harbor. Evaluation of the alternatives indicated that the optimum plan consists of dredging a 3-acre 6-ft deep anchorage protected by a series of 11 icebreaker structures, to be located to the east of the existing city pier and adjacent of the existing Federal navigation channel in the Saco River, as well as two icebreaker structures to be located to the west of the city pier and placed to protect that structure. Based on projected waterway use, the selected plan is economically justified. Total cost would be $237,700. Annual charges of $29,000 when compared to annual project benefits of $121,700 yield a benefit-cost ratio of 4.2:1. Due to the commercial nature of the project, the cost would be borne totally by the Federal government. It is anticipated that maintenance of the anchorage will be required every 6 years, and replacement of the icebreakers will be required every 25 years. Maintenance of the project will be a Federal reponsibility.
W86-03322

8B. Hydraulics

FLOODFLOW CHARACTERISTICS OF FILBIN CREEK AT PROPOSED INTERSTATE HIGHWAY 526, NORTH CHARLESTON, SC,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 4C.
W86-02969

VIRDEN CREEK PUMPING STATION AND GRAVITY-FLOW OUTLET STRUCTURE, WATERLOO, IOWA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
E. D. Rothwell.
Technical Report HL-81-1, March 1981. Final Report. 42 p, 7 fig, 7 tab, 4 photos, 11 plates.

Descriptors: *Hydraulic models, *On-site inveation, *Pumping plants, *Gravity flow, *Outlets, *Surveys, Hydraulic design, Conduits, Hydraulics, Flow, Fluid flow, Virden Creek, Cedar River, Iowa.

The model study was conducted to evaluate the characteristics of the pumped and gravity flows through the proposed structures from Virden Creek into the Cedar River and to develop practical modification if required to improve the hydraulic performance of the structures. Hydraulic performance of the original design four-conduit gravity-flow structure was inadequate with unsymmetrical flow. This was attributed to the existing structures and the indirect approach to the gravity structure. This unsymmetrical flow through the original four-conduit gravity-flow structure was improved by a three-conduit structure which enhanced the hydraulic and structural adequacy of the gravity-flow outlet structure. Hydraulic performance of the original converging-sidewall, low-submergence pump sump indicated that air-entraining surface vortices would occur imtermittently in the vicinity of the pump intakes. A modified pump sump with rounded approach pier noses and a hydraulic performance. Sediment deposition expected during gravity-flow operations was simulated with results indicating that normal sand and gravel deposits should not affect performance of the pumping station with the gates to the pump sump closed during gravity-flow conditions.
W86-03299

HYDRAULIC MODEL STUDIES OF BARTLETT DAM,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
P. H. Burgi, and K. L. Houston.
Available from Engineering and Research Center, Denver, CO. Report No GR-81-3, May 1981. 63 p, 30 fig, 3 tab, 2 app.

Descriptors: *Dam design, *Model studies, *Hydraulic models, *Models, *Dam construction, *Spillway gates, *Buttress dams, Dams, Dam stability, Flood discharge, Arizona.

Hydraulic model studies were conducted to investigate recommended plunge pool design changes for protection of the Bartlett Dam spillway chute. The model was also used to study spillway gate sequencing for low discharges, overtopping of the five center bays of the buttress dam during flood discharges, and calibration of the free flow and gate-controlled spillway discharges. The initial topography which resulted from the March 1978 spillway discharges, and two proposed plunge pool design modifications were tested in the model. Based on impact pressure data and visual observations, the Concrete Dams Section staff designed a concrete mat to prevent further upstream erosion of the rock at the base of the spillway chute. An operational procedure was developed for spillway gate sequencing to prevent overtopping of the left training wall during low discharges. The sequencing of gates was also studied to deflect the flow away from the right side of the plunge pool during repairs in 1979. Two river channel modifications downstream from the plunge pool were studied in the model. To pass flood discharges greater than 6031 cu m/sec, the five center bays of the buttress dam will be overtopped.
W86-03343

FLOW MEASUREMENT FLUMES: APPLICATIONS TO IRRIGATION WATER MANAGEMENT,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and M. G. Bos.
IN: Advances in Irrigation, Volume 1, 1982. p 147-217, 23 fig, 12 tab, 20 ref.

Descriptors: *Flumes, *Weirs, *Irrigation engineering, *Irrigation design, *Irrigation ditches, Irrigation canals, Hydraulic design, Hydraulic equipment, Hydraulic engineering, Hydraulic structures, Theoretical analysis, Models, Numerical analysis, Canal design, Flow measurement.

The design, theory, and application of long-throated flumes, particularly the hydraulically related broad-crested weirs, to irrigation flow measurements in delivery-system canals and farm ditches, both lined and unlined are considered. The use of long-throated flumes is recommended for measuring flows in open channels whenever the water surface at the control section must remain free. Types of long-throated flumes include the trapezoidal flumes, complex shape flumes, and the broad-crested weirs. Flow in long-throated flumes is governed by the principles of critical flow. Modular limits vary widely for various weirs and flumes and is usually related to the degree of parallel flow achieved in the throat section and the friction and eddy losses caused by the structure and the associated downstream expansion section, if one is used. A numerical example for a trapezoidal flume in a trapezoidal channel is given along with a discussion of the mathematical modeling of long-throated flumes. Factors which influence calibration include dimensional errors of construction, errors in zeroing the readout device, roughness changes with time, seasonal temperature effects on fluid viscosity, and sensitivity of the readout device. Selection of flume style and site are considered along with numerical examples for the selection of flume dimensions for trapezoidal lined canals. Structures and adaptations to fit flumes into unlined canals are examined. (Geiger-PTT)
W86-03404

FLUID FLOWS: PUMPS, PIPES AND CHANNELS,
Exxon Research and Engineering Co., Florham Park, NJ.
N. P. Cheremisinoff.
Ann Arbor Science, Ann Arbor, MI. 1982. 623 p, 3 append.

Descriptors: *Hydraulics, *Fluid flow, *Pumping, Pipes, *Channel flow, Flow, Pressure-measuring instruments, Manometers, Viscosity, Laminar flow, Capillarity, Shear stress, Turbulent flow, *Pipe flow, Dimensional analysis, Friction, Hydraulic valves, Pumps, Flow rates, Drag, Roughness coefficient, Reynolds number, Network design, Valves, Flow measurement, Flow around objects, Flow characteristics, Flowmeters, Cavitation, Weirs, Flumes, Nonnewtonian flow, *Open-channel flow.

An introductory and practical reference text to standard process flow problems is directed to engineering students in fluid mechanics, engineers reviewing principles and calculations, and process engineers in first job positions. The first of the book's two sections is a review of basic fluid mechanics principles. Chapters include systems of units (including the International System), fluid statics and pressure measurement, properties of fluids, motion and energy equations, laminar flow, turbulence, and dimensional analysis. In the second section these principles are applied to specific design practices for handling incompressible flows (liquids), particularly handling and transportation aspects. Chapters on piping systems discuss calculation methods for pressure drop and flow parameters through piping and devices for flow control and measurement. Chapters on pumping operations include pump classifications, pump performances and characteristics, pump selection, oscillating displacement pumps, mechanical seals for pumps, and cavitation. Flow, usually turbulent, of Newtonian fluids past immersed bodies relates to heat exchangers and cooling towers. Flow of non-Newtonian fluids deals with laminar flow conditions. Open channel flow characteristics and control principles are applied to flow through sluice gates and flumes, over weirs, and in sewers. (Cassar-PTT)
W86-03415

8C. Hydraulic Machinery

AUTOMATED PLUGGING FACTOR MONITOR: SPECIFICATIONS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 3A.
W86-03325

AUTOMATIC GENERATION CONTROLLER FOR FLATIRON DISPATCH CENTER-LARAMIE RIVER POWER STATION REMOTE TERMINAL UNIT,

Bureau of Reclamation, Denver, CO. Engineering and Research Center.
S. C. Stitt, and G. Brown.
Available from Engineering and Research Center, Denver, CO. Report No. REC-ERC-81-11, November 1981. 102 p, 1 tab, 7 app, 6 ref.

Descriptors: *Computers, *Control systems, *Automation, *Computer programs, *Data transmission, *Electric powerplants, Data processing, Powerplants, Electric power production, Monitoring.

The operation and maintenance of the Flatiron Automatic Generation Controller (AGC) Interim Controller (FAIC) remote terminal units (RTU) installed at Laramie River Powerplant are described. One RTU is provided for each of the three generators with the fourth unit provided as a spare. Two of the RTU's will be used to monitor and control the two Laramie River generators which will render power to the Flatiron AGC control area or the west area. These RTU's will send and receive control signals from the FAIC master station which is located at the Western Area Power Administration's Flatiron Dispatch Center. The third RTU will communicate with the Watertown AGC computer located at Watertown, South Dakota.
W86-03326

HYDRAULIC MODEL STUDIES OF MODIFICATION TO KLANG GATES DAM, MALAYSIA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
K. Gibson, and R. A. Dodge.
Available from Engineering and Research Center, Denver, CO. Report No GR-82-12, March 1983. 23 p, 19 fig, 3 tab.

Descriptors: *Hydraulic equipment, *Model studies, *Hydraulic gates, *Radial gates, *Spillway gates, *Hydraulic models, Models, *Hydraulic machinery, Dams, Spillways, Dam design.

A hydraulic model was used to study a proposed modification to Klang Gates Dam, Malaysia. To raise the reservoir elevation 3.05 m, four radial gates were to be added to the double-curvature spillway. Spillway pressures were measured for a flush sillplate and a raised sillplate to accommodate the gates to the curvatures of the spillway. Discharge calibration curves were determined for various gate openings. Hydraulic performance of the proposed spillway modification proved satisfactory. At the design reservoir elevation of 97.8 m and with the gates fully opened, the release was 376.6 cu m/sec. A higher discharges, damage to the gabions and control house by scour, flood, or wave action appeared possible. It was recommended that calibration curves for gate openings smaller than 152 mm be determined in the field by gaging the stream. Four-gate operation is recommended for as low a discharge as is compatible with accuracy requirements and/or confidence in the calibrations developed from the downstream gaging.
W86-03329

CASS - A MICROCOMPUTER CONTROL SYSTEM FOR GRAND COULEE AGC SIGNALS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. R. Schurz, and T. R. Valdez.
Available from Engineering and Research Center, Denver, CO. Report No GR-81-6, August 1981. 64 p, 8 fig, 3 app, 3 ref.

Descriptors: *Computers, *Control systems, *Automation, *Electric power production, *Electric powerplants, *Data transmission, Powerplants, Computer programs, Electronic equipment, Data processing, Grand Coulee Dam, Washington.

A processor dubbed the Coulee Automatic Generation Control (AGC) Signal Stuffer (CASS) was developed and installed at Grand Coulee Powerplant in November 1980. This processor allows the Bonneville Power Administration to receive the actual plant total power generation with minimal delay, thus allowing EPA to implement AGC control of Grand Coulee. As an added benefit, the CASS processor derives and sends to the Grand Coulee programmable master supervisory control a value for substitute generation which relieves the operator of the duty of manually entering changes in substitute generation. The theory, operation, and program flow charts for the new microcomputer control system are presented. The AGC system should prove more predictable and stable as a result of this installation.
W86-03330

LABORATORY TESTS OF A HYDRAULIC PRESSURE SURGE RELIEVER,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
B. W. Mefford.
Available from Engineering and Research Center, Denver, CO. Report No GR-83-4, September 1983. 25 p, 8 fig, 1 app, 4 ref.

Descriptors: *Hydraulic machinery, *Hydraulic valves, *Hydraulic gates, *Model studies, *Models, *Mathematical models, *Simulation analysis, *Surges, Hydraulic equipment, Water pressure, Laboratory tests.

The positive pressure surge reliever capability of the Grove Flexflo Model 887 Surge Reliever Valve was evaluated in laboratory tests. The 4-inch relief valve, supplied by the Grove Valve and Regulator Company, was designed to reduce positive pressure surges in water pipelines by placing it on a pipeline upstream of a quick closing gate valve. During the tests, the gate valve was slammed shut to produce a sharp pressure wave traveling upstream. Performance of the surge reliever valve was determined by measuring the reduction in the pressure wave as it traveled past the valve. Results showed that the Flexflo surge reliever valve is capable of significantly reducing pressure amplitudes of common hydraulic transients. The valve is capable of reacting to overpressure in 8 to 10 milliseconds. Although the valve testing period was of a short duration, the valve proved reliable in all laboratory tests. Complex systems incorporating a relief valve or valves can be mathematically modeled to provide detailed system/valve sizing data.
W86-03340

VARIABLE SPEED A-C MOTOR CONTROLLER FOR CANAL GATE HOISTS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
D. Ehler.
Available from Engineering and Research Center, Denver, CO. Report No GR-83-1, March 1983. 24 p, 4 fig, 5 app.

Descriptors: *Hydraulic equipment, *Hydraulic gates, *Radial gates, *Electrical equipment, *Motors, Hydraulic machinery, Aqueducts, Canals.

A variable speed-motor controller for application to control large radial gate operation was tested in the laboratory. Results showed that the 3-hp variable-speed motor controller is sufficient to provide variable speed operation on the large gage hoists to be installed on the Granite Reef Aqueduct. Noise interference produced by the controller is low enough to be used in the field without causing interference to microprocessor, electronic, and communication circuits. The motor controller must be matched to the motor with respect to horsepower rating and revolutions per minute. The Parajust controller which is temperature rated conservatively will provide cyclic duty at elevated temperatures. D-C voltage motors with controllers provide better low speed control and are more efficient and economical for large horsepower ratings. A-C voltage motors with controllers offer lower cost, especially for induction motors, and require no brushes or slip rings.
W86-03341

8D. Soil Mechanics

HYDROLOGY, GEMORPHOLOGY, AND DAM-BREAK MODELING OF THE JULY 15, 1982, LAWN LAKE DAM AND CASCADE LAKE DAM FAILURES, LARIMER COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. D. Jarrett, and J. E. Costa.
Available from OFSS, USGS Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-612, 1984. 109 p, 72 fig, 13 tab, 29 ref.

Descriptors: Dams, *Dam failure, *Floods, *Geomorphology, Dam-break model, Flood routing, Alluvial fan, Earthdams, Flood damage, Hydraulic models, Computer models, *Colorado, Lawn Lake Dam, Cascade Lake Dam, *Piping(dam failure).

On July 15, 1982, Lawn Lake Dam, a 26-foot-high earthfill irrigation dam built in 1903 in Rocky Mountain National Park, Colorado, failed, due to piping, releasing 674 acre-feet of water with a peak discharge of 18,000 cubic feet per second down the Roaring River. Three people were killed, and damages were estimated at $31 million. Cascade Lake Dam, downstream from Lawn Lake Dam, subsequently failed as a result of the flood, increasing the peak flow at this point from 7,210 cubic feet per second to 16,000 cubic feet per second. The flood wave took 3.28 hours to travel 12.5 miles to Lake Estes, where all the floodwater was stored. The channel of the Roaring River was scoured as much as 50 feet and widened 300 feet. An alluvial fan of 42.3 acres, containing 10 million cubic feet of material, was deposited at the mouth of the Roaring River, damming the Fall River and forming a 17-acre lake. Various methods were used to indirectly compute peak discharge, attenuation of flow, and flood traveltime. A version of the National Weather Service dam-break flood model was used to evaluate its performance on high-gradient streams, to provide supplemental hydrologic information, and to evaluate various scenarios of dam-break development. (USGS)
W86-03017

FROST ACTION IN SOIL FOUNDATIONS AND CONTROL OF SURFACE STRUCTURE HEAVING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2C.
W86-03317

QUANTIFICATION OF PINHOLE TEST EQUIPMENT HYDRAULIC CHARACTERISTICS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. G. Acciardi.
Available from Engineering and Research Center, Denver, CO. Report No. REC-ERC-82-15, September 1982. 73 p, 15 fig, 8 tab, 4 app, 8 ref.

Descriptors: *Soil engineering, *Clays, *Soil properties, *Soil erosion, *Soil classification, *Soil analysis, *Soil tests, *Soil mechanics, Engineering, Soils, Erosion, Turbidity.

A modified pinhole test procedure for identifying dispersive clays was developed by the Bureau of Reclamation. These clays are highly susceptible to erosion and are unsuitable materials for earthwork construction. Changes to the original test procedure developed by Dr. James L. Sherard included increased emphasis on the use of system flow rates in the classification of dispersive soil grade, reduced emphasis on the qualitative test evaluation criteria such as final eroded pinhole size and discharge effluent turidity in the final dispersive grade classification, and designing the equipment to assure atmospheric pressure at the pinhole discharge and verification of the actual hydraulic head on the system. Routine laboratory testing and analysis of Sherard's original data was performed to substantiate proposed changes. An extremely high degree of correlation was found between

solid originally classified as dispersive by Sherard on the basis of effluent turbidity and subsequently reclassified as dispersive on the basis of system flow rates. The quantitative method of evaluating pinhole test results on the basis of flow rates showed considerable improvement over the original qualitative methods because subjective criteria and operator bias are eliminated.
W86-03323

CLOSED-SYSTEM FREEZING OF SOILS IN LININGS AND EARTH EMBANKMENT DAMS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones.
Report No REC-ERC-81-1, March 1981. 52 p, 36 fig, 3 app, 23 ref.

Descriptors: Closed systems, *Freezing, *Linings, *Embankments, Compacted soils, Canal linings, Frost, Frost protection, Soil water, *Soil engineering.

A brief review of studies of closed-system freezing (no source of water except that in voids) of compacted soils performed by other investigators, and the laboratory and field data collected from Water and Power Resources Service experiences are presented. For compacted soil canal linings, laboratory and field test results show that under certain soil and temperature conditions, freezing decreases soil density near the surface, but increases density at depth. In two linings, the average density increased slightly during a 20-year period. Frost penetration measurements made during the 1978-79 winter on a 1.5-m-thick reservoir lining, on three earth dams under construction, and on the Teton Dam remnant are shown along with associated soil conditions, air freezing indexes, and insulating effects of snow and, for one dam, a loose soil cover. There is a discussion of (1) frost penetration in different types of soil with and without gravel particles, (2) the effect of freezing on soil near the surface of partially completed earth dams during winter shutdown periods, (3) the need for investigating frost conditions in preparation for resumption of embankment placement in the spring, (4) a suggestion of possible detrimental freezing action at the interface between a rock abutment and an earth embankment, and (5) the possibility of crack formation caused by soil shrinkage during freezing action.
W86-03328

8E. Rock Mechanics and Geology

GRAVITY SURVEY AND DEPTH TO BEDROCK IN CARSON VALLEY, NEVADA-CALIFORNIA,
Geological Survey, Carson City, NV. Water Resources Div.
D. K. Maurer.
Available from OFSS, USGS, ox 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4202, 1985. 20 p, 2 fig, 17 ref.

Descriptors: *Alluvial deposits, *Bedrock, *Gravity studies, Geophysics, *Carson Valley, Depth to Bedrock, *Nevada, *California, Carson Range, Pine Nut Mountains.

Gravity data were obtained from 460 stations in Carson Valley, Nevada and California. The data have been interpreted to obtain a map of approximate depth to bedrock for use in a ground-water model of the valley. This map delineates the shape of the alluvium-filled basin and shows that the maximum depth to bedrock exceeds 5,000 feet, on the west side of the valley. A north-south trending offset in the bedrock surface shows that the Carson-Valley/Pine-Nut-Mountain block has not been tilted to the west as a simple unit, but is comprised of several smaller blocks. (USGS)
W86-03087

8F. Concrete

EVALUATION OF CONCRETE CORES, BLACK CANYON DAM, IDAHO,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
P. O. Castaneda.
Available from Engineering and Research Center, Denver, CO. Report No. GR-83-5, June 1983. 71 p, 2 fig, 1 tab, 2 app.

Descriptors: *Strength, *Core drilling, *Concrete technology, *Concrete dams, *Concrete construction, *Dam stability, *Concrete testing, *Petrography, Dam construction, Dams, Dam foundations, Dam design, Idaho.

In 1977, 6- and 10-inch diameter cores were extracted from Black Canyon Dam (Idaho) which was built by the Bureau of Reclamation in 1924. Results showed that the concrete in the dam is of good quality, with an average compressive strength of 4,500 pounds/sq inch and an average density of 155.4 pounds/cu ft. Petrographic studies showed that the concrete is of satisfactory physical and chemical quality. No evidence of alkali-aggregate reaction, sulfate or chloride attach, or freeze-thaw deterioration was observed in the interior concrete. Direct shear test results, analyzed by linear regression, were comparable to results obtained on other Bureau projects, with the cohesion on sliding friction tests averaging 215.5 pounds/sq inch, and the average angle of friction was 39 degrees. Sliding friction results indicated similar behavior in both unbonded and bonded joints. These results provide necessary data for design modifications required to withstand the redefined maximum inflow design flood and maximum credible earthquake.
W86-03324

THEODORE ROOSEVELT DAM CONCRETE CORE INVESTIGATIONS: 1981,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
T. A. Gaeto.
Available from Engineering and Research Center, Denver, CO. Report No GR-81-12, October 1981. 29 p, 10 fig, 2 tab, 1 app, 3 ref.

Descriptors: *Concrete dams, *Concrete technology, *Dam stability, *Concrete testing, *Concrete construction, *Dam foundations, *Core drilling, *Strength, Dams, Dam construction, Dam design, Reservoirs, Storage capacity. Theodore Roosevelt Dam, Arizona.

Tests made on concrete cores taken in 1979 and 1980 from Theodore Roosevelt Dam, Salt River Project, Arizona showed that the concrete in this dam constructed between 1903 and 1911 is in satisfactory condition. The average ratio of tensile to compressive strength in the concrete core specimens was about 4.4%, a normal value for mass concrete. The tensile bond strength at the rock-mortar interface was less than 50% of the tensile strength of the concrete itself. Cores received with disbonded segments were not concentrated in a specific area of the dam which may indicate that there is not significant stress in a particular area. Petrographic examinations confirmed that the concrete is in satisfactory physical condition, but there is some evidence of very minor deleterious chemical alteration. These tests were done to aid in ascertaining the feasibility of raising the structure to increase flood storage capacities of the reservoir.
W86-03332

EVALUATION OF CONCRETE CORES, ARROWROCK DAM, IDAHO,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
E. M. Harboe.
Available from Engineering and Research Center, Denver, CO. Report No GR-82-6, March 1982. 31 p, 13 fig, 4 tab.

Descriptors: *Dam construction, *Concrete dams, *Concrete technology, *Core drilling, *Dam stability, *Strength, *Concrete construction, *Concrete testing, Concretes, Dam foundations, Cements, Dams, Dam design, Idaho.

Construction of Arrowrock Dam was completed in 1915. This structure is unique in that it is one of three dams constructed with what was called sand-cement. In 1978, concrete cores were drilled from six locations in the dam. The evaluation of these cores will be used in a feasibility study for the possible modification of the structure. Compressive strength tests indicate a low compressive strength but no significant reduction from the control strengths established during construction. The difference in strength and modulus of elasticity of the concrete when tested in a wet condition, compared to cores tested in a dry condition, was greater than usually observed between wet and dry concrete. No explanation for this behavior was determined. Minor evidence of silica gel was observed but not to the extent that the structure would be affected by an alkali aggregate reaction. (Author)
W86-03342

8I. Fisheries Engineering

WATER QUALITY CRITERIA FOR PRIMARY NURSERY AREAS IN NORTH CAROLINA,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5C.
W86-03134

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN MONTANA, OCTOBER 1983 THROUGH SEPTEMBER 1984.
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 10C.
W86-03166

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION, FOR PUERTO RICO AND THE U.S. VIRGIN ISLANDS,
Geological Survey, San Juan, PR. Water Resources Div.
F. Quinones, and M. Lopez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-229, 1985. 21 p, 167 ref.

Descriptors: *Bibliographies, Publications, *Water Resources Investigations, U.S. Geological Survey, *Puerto Rico, *U.S. Virgin Islands, Vieques, Culebra, St. Thomas, St. John, St. Croix.

A bibliography of water-resources investigations conducted by the U.S. Geological Survey, Water Resources Division in Puerto Rico and the U.S. Virgin Islands was compiled. The bibliography includes an alphabetical listing by author as well as listings by general and specific areas in Puerto Rico and the U.S. Virgin Islands. The publications are also classified by type of report: Open File, Open-File Data Report, KWater-Supply Paper, Water-Resources Investigations, and Professional Paper. (USGS)
W86-03047

INVESTIGATIONS AND RESEARCH IN NEVADA BY THE WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1982-83,
Geological Survey, Carson City, NV. Water Resources Div.
T. Katzer, O. Mossburner, and W. D. Nichols.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 83-768, 1984. 40 p, 1 fig, 26 ref.

Descriptors: *Geothermal resources, *Groundwater, *Waste disposal, *Floods, *Sedimentation, Acid mine drainage, Hydrology, *Nevada, Statewide research investigations.

The Water Resources Division, U.S. Geological Survey, is charged with (1) maintaining a hydrologic network in Nevada that provides information on the status of the State's water resources and (2) engaging in technical water-resources investigations that have a high degree of transferability. To meet these broad objectives, 26 projects were active during fiscal year 1982, in cooperation with 36 Federal, State, and local agencies. Total funds were $3,319,455, of which State and local cooperative funding amounted to $741,500 and Federal funding (comprised of Geological Survey Federal and cooperative program plus funds from six other Federal agencies) amounted to $2,577,955 for the fiscal year. Projects other than continuing programs for collection of hydrologic data included the following topics of study: geothermal resources, areal ground-water resources and groundwater modeling, waste disposal, paleohydrology, acid mine drainage, the unsaturated zone, stream and reservoir sedimentation, river-quality modeling, flood hazards, and remote sensing in hydrology. In total, 26 reports and symposium abstracts were published or in press during fiscal year 1982. (USGS)
W86-03114

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN MONTANA, OCTOBER 1983 THROUGH SEPTEMBER 1984.
Geological Survey, Helena, MT. Water Resources Div.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-435, May 1984. 44 p, 3 fig, 2 tab, 132 ref.

Descriptors: Data collection, *Water resources projects, Water quality, Surface water, Groundwater, *Montana.

U.S. Geological Survey investigations of the water resources of Montana are described. Hydrologic information and knowledge of the water resources are gained and disseminated principally by programs of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies. The Montana district of the U.S. Geological Survey conducts its hydrologic work through a headquarters office in Helena, a subdistrict office in Billings, and field offices in Helena, Fort Peck, and Kalispell. The district employs 67 people to work on 25 funded projects that are organized under the general categories of data-collection programs, problem-oriented studies, a real appraisals, coal-related studies, research projects, and hydrologic studies and research performed under contracts to research organizations. (USGS)
W86-03166

10D. Specialized Information Center Services

OVERVIEW OF CAPABILITIES AVAILABLE THROUGH THE TNRIS GEOGRAPHIC INFORMATION SYSTEM.
Texas Natural Resources Information System, Austin.
TNRIS-017, September 1981. (Reprinted May 1982). 8 p.

Descriptors: *Natural resources, *Texas, *Information systems, Information exchange, Information retrieval, Geography, Computers, Automation, Computer programs, Mapping, Geologic mapping, Hydrologic maps.

The Texas Natural Resources Information System (TNRIS), which was established to provide maximum availability of natural resources data and related information to state, federal, regional, local, and private entities in Texas, is discussed. One aspect of the overall system, a Geographic Information System (GIS), which provides for computer processing of maps and other spatial data, is being developed as one of many analytical tools for handling TNRIS data. The current and anticipated near future TNRIS capabilities for handling spatial data, and procedures for making use of these capabilities are presented. (Halterman-PTT)
W86-03261

TEXAS NATURAL RESOURCES INFORMATION SYSTEM (TNRIS): A PROGRESS REPORT,
Texas Natural Resources Information System, Austin.
TNRIS-033, March 1983, 62 p, 14 fig, 8 tab, 27 ref, 2 append.

Descriptors: *Texas, *Natural resources, *Information systems, Information retrieval, Geography, Computers, Computer programs, Mapping, Geologic mapping, Hydrologic maps.

The origin, design, implementation, and growth of the Texas Natural Resources Information System (TNRIS) are discussed. A review of the various types of services and capabilities that have been developed over the past several years to support user needs is provided. Activities of the Task Force, its committees, and the TNRIS Systems Central staff described include conducting inventories, establishing a library of natural resource data and information, monitoring other systems, and providing an educational program for System staff and users. Also discussed are capabilities for data analysis, including remote sensing and geographic systems, which have been developed to support decision making by the participating State agencies. Examples are provided of the types of approaches used in processing user requests and discusses various assessments of the System that have been made by the Task Force and others. A number of future TNRIS objectives are noted, including planned emphasis on more efficient handling of user requests, additional capabilities for processing natural resource data, and improved means for maintaining current inventories of newly collected data. (Author)
W86-03263

COMPUTER BASED MAPPING SYSTEM FOR STORAGE AND RETRIEVAL OF SOIL AND LAND USE DATA: SUPPORT ACTIVITIES REPORT,
Texas Natural Resources Information System, Austin.
TNRIS-018, August 1982. 33 p, 8 fig, 5 ref, 2 append.

Descriptors: *Natural resources, *Texas, *Information systems, Information exchange, Information retrieval, Geography, Computers, Automation, Computer programs, Mapping, Geologic mapping, Hydrologic maps.

An automated system to store soils, surface water and land-use information, developed by the Texas Natural Resources Information System (TNRIS) and the Soil Conservation Service (SCS) in Texas, is described. The automated system provides capabilities to select data from master files of soil and land-use data for production of tabular reports and interpretive maps. Computer software from the Map Information Assembly and Display System (MIADS), developed by the Forest Service, was used in conjunction with TNRIS, and served as the foundation for development of the Computer Based Mapping System (CBMS). Using 15.55-acre grid cells, data for more than thirty-five counties have been included in CBMS. The production of line printer plots, and reports of acreage covered by each type of data stored, is discussed. The use of these interpretive maps by Texas agencies is also discussed. (Halterman-PTT)
W86-03279

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W86-03257	6B	W86-03299	8B	W86-03341	8C	W86-03383	2H
W86-03258	2C	W86-03300	6E	W86-03342	8F	W86-03384	5C
W86-03259	6E	W86-03301	8A	W86-03343	8B	W86-03385	5C
W86-03260	2A	W86-03302	6G	W86-03344	5B	W86-03386	2H
W86-03261	10D	W86-03303	2H	W86-03345	5B	W86-03387	2E
W86-03262	5A	W86-03304	8A	W86-03346	5B	W86-03388	2E
W86-03263	10D	W86-03305	8A	W86-03347	5C	W86-03389	5C
W86-03264	6C	W86-03306	5B	W86-03348	5C	W86-03390	5C
W86-03265	5C	W86-03307	8A	W86-03349	5C	W86-03391	5C
W86-03266	5F	W86-03308	2K	W86-03350	5C	W86-03392	5B
W86-03267	5D	W86-03309	5C	W86-03351	5C	W86-03393	5C
W86-03268	4B	W86-03310	2A	W86-03352	5B	W86-03394	5C
W86-03269	2J	W86-03311	5D	W86-03353	5C	W86-03395	5C
W86-03270	5E	W86-03312	2A	W86-03354	5C	W86-03396	5B
W86-03271	5C	W86-03313	7A	W86-03355	5C	W86-03397	5C
W86-03272	7B	W86-03314	5B	W86-03356	5G	W86-03398	3F
W86-03273	5B	W86-03315	5B	W86-03357	5G	W86-03399	3F
W86-03274	3C	W86-03316	2F	W86-03358	5G	W86-03400	3F
W86-03275	5E	W86-03317	2C	W86-03359	5A	W86-03401	3F
W86-03276	6B	W86-03318	5D	W86-03360	5E	W86-03402	3F
W86-03277	7B	W86-03319	5C	W86-03361	5C	W86-03403	3F
W86-03278	2B	W86-03320	2J	W86-03362	5B	W86-03404	8B
W86-03279	10D	W86-03321	6B	W86-03363	5B	W86-03405	3F
W86-03280	5G	W86-03322	8A	W86-03364	5B	W86-03406	5A
W86-03281	5B	W86-03323	8D	W86-03365	5B	W86-03407	5A
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W86-03286	5A	W86-03328	8D	W86-03370	5B	W86-03412	5A
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W86-03291	2J	W86-03333	2K	W86-03375	5C	W86-03417	5B
W86-03292	2A	W86-03334	5B	W86-03376	5C	W86-03418	5B
W86-03293	7B	W86-03335	3A	W86-03377	5C	W86-03419	5B
W86-03294	2A	W86-03336	6G	W86-03378	5C		
W86-03295	5D	W86-03337	6G	W86-03379	2H		
W86-03296	8A	W86-03338	5B	W86-03380	2E		

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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N02	48.00

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E02	10.00
E03	11.00
E04	13.50
E05	15.50
E06	18.00
E07	20.50
E08	23.00
E09	25.50
E10	28.00
E11	30.50
E12	33.00
E13	35.50
E14	38.50
E15	42.00
E16	46.00
E17	50.00
E18	54.00
E19	60.00
E20	70.00
E99	*

T01	$145.00
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T03	275.00
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